FISCAL YEAR 2022 ANNUAL MONITORING PLAN

FOR

CITY AND COUNTY OF HONOLULU
MUNICIPAL SEPARATE STORM SEWER SYSTEM
NPDES PERMIT NO. HI S000002

COVERING THE PERIOD:
JULY 1, 2021 TO JUNE 30, 2022

FEBRUARY 2021 DRAFT

Prepared By:
City and County of Honolulu
Department of Facility Maintenance
Kapolei, Hawaii

BE AN EVERYDAY
CLEAN WATER
HERO

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Table of Contents

List of Figures

List of Tables

List of Appendices

List of Acronyms

BLS	Baseline Load Study
BMP	Best Management Practice
CASQA	California Stormwater Quality Association
City	City and County of Honolulu
Corps	United States Army Corps of Engineers (or USACE)
CWA	Clean Water Act
DFM	City and County of Honolulu, Department of Facility Maintenance
DFM-SWQ	City and County of Honolulu, Department of Facility Maintenance, Storm Water Quality Division
DLNR	State of Hawaii, Department of Land and Natural Resources
DOH	State of Hawaii, Department of Health
DOT-HWYs	State of Hawaii, Department of Transportation, Highway Division
DTS	City and County of Honolulu, Department of Transportation Services
EMC	Event Mean Concentration
ENV	City and County of Honolulu, Department of Environmental Services
EPA	United Stated Environmental Protection Agency
EOP	End-of-Pipe
EWI	Equal-Weight Increment
FY	Fiscal Year
GPS	Global Positioning System
HSPF	Hydrological Stimulation Program - Fortran
I&M	Implementation and Monitoring
MEP	Maximum Extent Practicable
MFR	Multi-Family Residential
MS4	Municipal Separate Storm Sewer System
$NO_3 + NO_2$	Nitrate + Nitrite

NPDES	National Pollutant Discharge Elimination System
PEAP	Program Effectiveness Assessment Plan
Permit	National Pollutant Discharge Elimination System Permit No. HI S000002
Plan	Annual Monitoring Plan
PLOAD	Pollutant Loading Estimator
Response Plan	Response Plan for Investigations and Illegal Discharges
QA	Quality Assurance
QC	Quality Control
SFR	Single Family Residential
State	State of Hawaii
SWMM	Storm Water Management Model
SWMP	Storm Water Management Program
SWMPP	Storm Water Management Program Plan
TBD	To Be Determined
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
UH	University of Hawaii, Manoa
USACE	United States Army Corps of Engineers (or Corps)
USGS	United States Geological Survey
WLA	Wasteload Allocation
WRS	Weighed Risk Score

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Executive Summary

The City and County of Honolulu (City) National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit No. HI S000002 (Permit) was issued by the State of Hawaii (State), Department of Health (DOH) and became effective on September 1,2020. The Permit will expire on August 31, 2025.

Pursuant to Part F.1(a) of the Permit, an Annual Monitoring Plan is required to be submitted to the DOH by June 1st of each year for monitoring activities planned during the upcoming fiscal year (FY). This Annual Monitoring Plan (Plan) covers FY 2022 (FY22), which is the period from July 1, 2021 through June 30, 2022.

The Plan includes a written narrative of the proposed Plan's objectives and description of activities to be implemented over the coming fiscal year as described in the Permit. For FY22, the City is proposing the following ten (10) elements:

1. Total Maximum Daily Load (TMDL) Wasteload Allocation (WLA) Monitoring Program
2. Receiving and MS4 Water Quality Monitoring Program
3. Dry Weather Outfall Field Screening Program
4. Watershed Water Quality Monitoring Programs
5. Bioassessment Monitoring Program
6. Palolo Stream Focused Watershed Plan
7. Trash Reduction Monitoring Plan
8. Street Sweeping Pilot Study
9. City MS4 Municipal Facilities Monitoring Program
10. Storm Water Management Program (SWMP) Effectiveness Assessment Plan

Each of these monitoring components addresses a specific part of the Permit/SWMP and, in many cases, are inter-related. This Plan contains a description of monitoring activities the City believes will help identify and quantify the sources of many of the targeted pollutants, which will aid in the long-term goal of obtaining realistic load reductions needed to improve water quality in the State's receiving waters. Through the implementation of various Best Management Practices (BMPs) or programs available to the City, including partnering with many of the various stakeholders that have a responsibility in each watershed, the City will be able to report meaningful and sustainable changes in water quality along with complying with its Permit obligations.

Due to the economic impacts of the COVID-19 pandemic and expected future budget cuts, it is estimated that the monitoring budget for FY22 will be around $1,850,000, which accounts for roughly a 25% reduction in overall spending. This includes end-of-pipe and stream sampling, development of monitoring work plans, lab analyses, United States Geological Survey (USGS) joint monitoring agreements, biological assessments, Implementation and Monitoring (I&M) plans to address the seven (7) TMDL WLAs, BMP implementation, TMDL tracking activities, and other partnership monitoring efforts described in the Plan pending budget approvals.

Projected expenditures require approval from the City Council and are subject to change based on MS4 Permit negotiations and program activities that may be revised to be consistent with Permit conditions.

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I. INTRODUCTION

The City and County of Honolulu (City) National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit No. HI S000002 (Permit) was issued by the State of Hawaii (State), Department of Health (DOH) with an effective date of September 1, 2020. The Permit and the authorization to discharge will expire on August 31, 2025.

The designated Permittee who administers the NPDES MS4 is the City's Department of Facility Maintenance (DFM). Historically, the Department of Environmental Services (ENV) administered the NPDES MS4 program through the Storm Water Quality Branch (SWQ). On July 1, 2015, the SWQ officially transferred to the DFM, who now administers the program. As of February 5, 2020, the Storm Water Quality Branch was designated as the Storm Water Quality Division under DFM.

Pursuant to Part F.1(a) of the Permit, the following Annual Monitoring Plan (Plan) is being submitted for monitoring activities planned for Fiscal Year 2022 (FY22), which is the period from July 1, 2021 through June 30, 2022.

The monitoring program was designed and implemented to meet the following objectives:

Part F.1.a.(1) Assess compliance with the Permit;

Part F.1.a.(2) Measure the effectiveness of the storm water management plan;

Part F.1.a.(3) Assess the overall health based on the chemical, physical, and biological impacts to receiving waters resulting from storm water discharges and an evaluation of the long-term trends;

Part F.1.a.(4) Characterize storm water discharges from the MS4;

Part F.1.a.(5) Identify sources of specific pollutants;

Part F.1.a.(6) Detect and eliminate illicit discharges and illegal connections to the MS4; and

Part F.1.a.(7) Assess the water quality issues in each watershed resulting from storm water discharges from the City's MS4.

As described in the Permit, the Permittee shall submit the Annual Monitoring Plan by June 1st of each year that outlines the proposed monitoring activities to be implemented over the coming fiscal year. Results of all monitoring activities during that fiscal year are summarized in the Annual Monitoring Report submitted by October 31st of each year to the DOH. The Annual Monitoring Report is included as a chapter in the Annual Report, which is also submitted to DOH on October 31st of each year.

This Plan includes a written narrative of the following items:

- Proposed objectives and description of activities;
- Description of how the results will be used to determine compliance with the Permit, specifically Part F.2 and Part F.3;
- Documentation of a plan to collect flow and rainfall characteristics, water quality parameters to be tested, and flows to be monitored;

- Documentation of the analytical methods to be used;
- Documentation of the Quality Assurance/Quality Control procedures to be used; and
- Estimated budget to be implemented over the coming fiscal year.

II. PROPOSED MONITORING PLAN FOR FY22

The overarching goal for the City's monitoring program required under the Permit relates to both managing and assessing the effectiveness of the Storm Water Management Program (SWMP). The primary objective of the SWMP is to reduce, to the Maximum Extent Practicable (MEP), pollutants discharged from the City's MS4 to State waters, and to evaluate monitoring data, which can support management decisions made by the City to fine-tune the SWMP to meet its primary objective. Therefore, the purpose of the water quality monitoring program is both to meet the requirements of the Permit and to address key management questions.

In addition, implementing an effective water quality based monitoring program can potentially serve several needs by identifying trends in water quality and documenting long-term conditions. In many cases, monitoring for storm water management purposes is coordinated with other pollutant tracking and reduction programs. For example, monitoring data may be used to support the tracking and compliance with Total Maximum Daily Loads (TMDL) Waste Load Allocations (WLAs), as well as program effectiveness as it relates to public outreach and/or Best Management Practice (BMP) efficiencies such as detention basin removal rates.

The DFM-SWQ proposed monitoring plan for FY22 is comprised of the following ten (10) elements:

1. Total Maximum Daily Load Waste Load Allocation Monitoring Program
2. Receiving and MS4 Water Quality Monitoring Program
3. Dry Weather Outfall Field Screening Program
4. Watershed Water Quality Management Program
5. Bioassessment Monitoring Program
6. Palolo Stream Focused Watershed Plan
7. Trash Reduction Monitoring Plan
8. Street Sweeping Pilot Study
9. City MS4 Municipal Facilities Monitoring Program
10. SWMP Program Effectiveness Assessment Plan

These programs were designed to either meet the requirements of the Permit/SWMP or to track and report the City's activities as it relates to the TMDL Program. **Figure 1** is a graphical flow chart that identifies how each program element relates to the Permit. Many of the program elements are directly tied into the SWMP effectiveness program while others, such as the Bioassessment and Watershed Management Programs, are holistic approaches that help determine if the City's MS4 program has had any positive long-term water quality impacts on receiving waters.

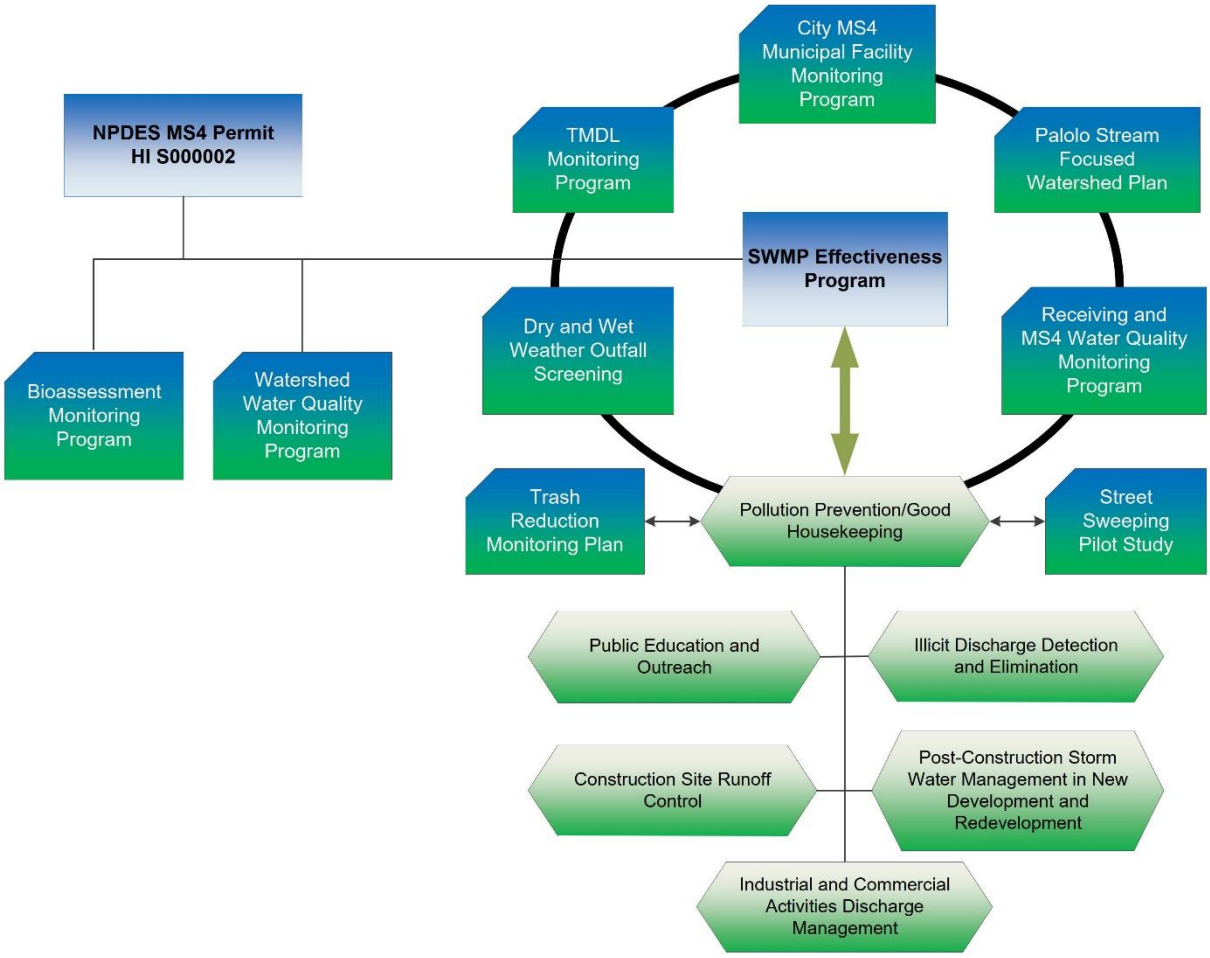

Figure 1: City NPDES MS4 Monitoring Program Flow Diagram

A. TOTAL MAXIMUM DAILY LOAD (TMDL) WASTE LOAD ALLOCATION (WLA) MONITORING PROGRAM

Part F.3.a. of the Permit requires the City to implement the TMDL Implementation and Monitoring (I&M) Plans for Ala Wai Canal, Waimanalo Stream, Kapaa Stream, Kaneohe Stream, Kawa Stream, North Fork of Upper Kaukonahua Stream, and Waikele Stream.

Specific activities described in each plan to achieve compliance with the City's WLAs typically focus on the following:

- Public outreach efforts such as community surveys, informational flyers, volunteer cleanups, and public-private partnerships informing homeowners/businesses of how their actions affect water quality;
- Public outreach efforts targeted to specific homeowners who could make improvements around their homes such as disconnecting roof drains, sweeping their curb and gutters, reducing fertilizer usage, and implementing green infrastructure practices on their property such as rain barrels, rain gardens, vegetative swales;

- Routine street sweeping;
- Grounds maintenance at various City facilities;
- Inspection and cleaning of drainage structures and conveyances;
- Stream maintenance; and
- Structural Water Quality Source and Treatment Control BMPs.

During FY22, the City will continue to implement the I&M Plans and monitor various activities to quantify the pollutant load reductions necessary to comply with the City's WLAs. In addition, the City is preparing to submit a petition to the U.S. EPA to revise the City's WLA load reductions by incorporating updated precipitation information, site-specific water quality data, and other relevant modifications. If the petition is accepted in part or in whole, the City's WLA load reductions may change.

While the U.S. EPA petition is pending, the DFM-SWQ will continue to work jointly with other stakeholders to facilitate an implementation and monitoring plan in the impaired TMDL watersheds for the purpose of meeting the required WLA load reductions. Possible stakeholders include the State Department of Transportation, the University of Hawaii, the State Department of Land and Natural Resources (DLNR), the U.S. Army, the U.S. Navy, the U.S. Department of Agriculture, the State Department of Education, and/or private companies/landowners depending on what other permittees are identified in a particular watershed. The goal of collaboration is to implement specific water quality improvement activities to reduce the pollutants that are identified in each of the respective TMDL reports and demonstrate compliance with the WLAs.

The City is also considering the development and implementation of a Water Quality Credit Trading Program to meet its regulatory obligations. This would involve purchasing equivalent or higher pollutant load reductions from another agency or stakeholder which can implement pollution control measures in off-site areas at a lower cost. Trading allows for potentially significant cost savings by enabling permittees the flexibility to implement technologies and land use practices in a less expensive location, while still meeting their regulatory obligations. Water quality credit trading has the additional benefit of encouraging the public, who are otherwise not obligated to comply with pollution reduction measures, to voluntarily remove non-point source loads that are contributing to the impairment of the water body. The U.S. EPA is a strong supporter of water quality trading, and their current policy applies to sediment and nutrient load reductions which are applicable to the TMDL watersheds.

B. RECEIVING AND MS4 WATER QUALITY MONITORING PROGRAM

1) In-Stream Baseline Grab Sampling

Beginning in 1997, the ENV (now DFM-SWQ) began taking monthly in-stream grab samples from the Manoa, Waihi, and Waiakeakua Streams, which are considered to be the primary streams that flow through the Manoa Watershed. Samples were collected at the same location in each stream and were analyzed for the following water quality parameters: Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Total Kjeldahl Nitrogen (TKN), Nitrate+Nitrite as Nitrogen (NO_3+NO_2 as N), Total Nitrogen (TN), Total Phosphorus (TP), Specific Conductivity, Turbidity, Dissolved Oxygen, pH, and water temperature, as required by the City's MS4 Permit.

In FY10, the ENV modified its stream sampling approach to focus the majority of its sampling resources towards the State's TMDL program. Sampling sites were selected based off the three (3) initial TMDL approved watersheds, which included the Ala Wai Canal, Kawa Stream, and Waimanalo Stream watersheds. Field monitoring equipment such as the YSI 6600 Multi-Parameter Water Quality Sonde was used to collect water quality data supplemented by grab sampling to be analyzed for nutrients and TSS. The DFM-SWQ continues to focus its in-stream water quality monitoring activities in those three (3) areas, and additionally began collecting data from Kapaa Stream starting in FY11, followed by Kaneohe Stream in FY14.

During FY22, the DFM-SWQ will continue to collect samples from each of the described sampling locations for each TMDL receiving water except the North Fork of Upper Kaukonahua Stream and Waikele Stream due to the lack of accessible sampling locations. The sampling will be quarterly, not monthly, due to the increased number of sample locations and the limited availability of personnel. At least two (2) representative samples will be collected at each stream site during each of the wet and dry seasons. Samples will be collected during either baseflow or stormflow conditions in the stream, depending on the weather at the time of sampling. The same water quality parameters identified above will be monitored during each sampling event, in addition to ammonia nitrogen. If there was rain on the sampling day, the total rainfall depth, duration, location, and storm event return time are also documented, along with visual observations of the stream water conditions (e.g. floatables, deposits, color, etc.).

Each of the locations described in **Table 1** were determined based on accessibility and ability to collect a representative sample.

Table 1: In-Stream Baseline Grab Sampling Points

Station ID	Location Description	GPS Coordinates
Manoa Stream (# of Sampling Points: 7) [See Figure 2]		
Manoa #1	Bridge at end of Private Road near Waaloa Way	21°19'42.468"N (Latitude) 157°47'57.748"W (Longitude)
Manoa #2	Bridge at end of Waaloa Way	21°19'42.285"N (Latitude) 157°48'2.789"W (Longitude)
Manoa #3	Bridge at Private Road near end of Waakua Street	21°19'38.877"N (Latitude) 157°48'2.004"W (Longitude)
Manoa #4	Bridge at Manoa District Park entrance and end of Kahaloa Drive	21°18'48.837"N (Latitude) 157°48'23.471"W (Longitude)
Manoa #5	Bridge at Woodlawn Drive	21°18'28.909"N (Latitude) 157°48'32.89"W (Longitude)
Manoa #6	Near Old USGS Sampling Station at Kanewai Field	21°17'35.862"N (Latitude) 157°48'45.73"W (Longitude)
Manoa #7	Bridge at Kapiolani Boulevard (Mauka Side)	21°17'18.479"N (Latitude) 157°49'1.006"W (Longitude)
Makiki Stream (# of Sampling Points: 3) [See Figure 3]		
Makiki #1	Near BWS Makiki Pump Station at Makiki Heights Drive	21°18'35.182"N (Latitude) 157°49'49.78"W (Longitude)
Makiki #2	Wilder Street near Poki Street	21°18'12.783"N (Latitude) 157°50'1.28"W (Longitude)
Makiki #3	Near Corner of King Street and Kalakaua Avenue	21°17'49.422"N (Latitude) 157°50'12.043"W (Longitude)

Table 1: In-Stream Baseline Grab Sampling Points (Continued)

Station ID	Location Description	GPS Coordinates
Palolo Stream (# of Sampling Points: 5) [See Figure 4]		
Palolo #1	End of Palolo Place	21°18'24.058"N (Latitude) 157°47'17.641"W (Longitude)
Palolo #2	Bridge at 10th Avenue	21°18'4.814"N (Latitude) 157°47'24.94"W (Longitude)
Palolo #3	Bridge at Kiwila Street	21°17'58.248"N (Latitude) 157°47'38.862"W (Longitude)
Palolo #4	Bridge at Entrance to Chaminade University	21°17'18.545"N (Latitude) 157°48'32.591"W (Longitude)
Palolo #5	Koali Road before Confluence to Manoa Stream	21°17'26.323"N (Latitude) 157°48'51.908"W(Longitude)
Kawa Stream (# of Sampling Points: 3) [See Figure 5]		
Kawa #1	Drainage Channel at Mokulele Drive near Kumakua Place	21°23'44.95"N (Latitude) 157°47'35.315"W (Longitude)
Kawa #2	Drainage Easement Upstream of Bridge at Namoku Street*	21°23'58.754"N (Latitude) 157°47'28.09"W (Longitude)
Kawa #3	Open Lot Before Bridge at Kaneohe Bay Drive	21°24'20.117"N (Latitude) 157°47'26.89"W (Longitude)
Waimanalo Stream (# of Sampling Points: 6) [See Figure 6]		
Waimanalo #1	Drainage Ditch near Olomana Gardens	21°20'28.081"N (Latitude) 157°44'42.483"W (Longitude)
Waimanalo #2	Drainage Ditch upstream of Waikupanaha Street	21°20'18.345"N (Latitude) 157°44'10.431"W (Longitude)
Waimanalo #3	Bridge on Private Road at 41-659D Kumuhau Street	21°20'45.924"N (Latitude) 157°44'5.226"W (Longitude)
Waimanalo #4	Drainage Ditch near 41-1612 Koa Moali Place	21°20'39.009"N (Latitude) 157°43'35.59"W (Longitude)
Waimanalo #5	Downstream of Bridge along Kalanianaole Hwy near Mekia Street	21°20'53.682"N (Latitude) 157°43'22.976"W (Longitude)
Waimanalo #6	Upstream of Bridge at Saddle City Road	21°21'10.446"N (Latitude) 157°43'26.764"W (Longitude)

* If sampling is conducted during rain events and stormflow is observed from outfalls near Namoku Street bridge, samples may be collected downstream of bridge as long as sampling at that location can be completed without compromising grab samples.

Table 1: In-Stream Baseline Grab Sampling Points (Continued)

Kapaa Stream (# of Sampling Points: 1) [See Figure 7]		
Kapaa #1	At Bend and Downstream of Kapaa Quarry Road	21°24'12.452"N (Latitude) 157°45'59.343"W (Longitude)
Kaneohe Stream (# of Sampling Points: 4) [See Figure 8]		
Kaneohe #1	At Hoomaluhia Botanical Garden Road	21°23'30.394"N (Latitude) 157°48'34"W (Longitude)
Kaneohe #2	Bridge at Luluku Road	21°23'57.067"N (Latitude) 157°48'9.052"W (Longitude)
Kaneohe #3	At Anoi Road	21°24'36.152"N (Latitude) 157°48'16.701"W (Longitude)
Kaneohe #4	At the back of Kaneohe Neighborhood Park	21°24'42.405"N Latitude) 157°47'54.262"W (Longitude)
Upper Kaukonahua Stream (# of Sampling Points: 0)**		
Waikele Stream (# of Sampling Points: 0)**		

**No sampling points proposed for Upper Kaukonahua Stream and Waikele Stream due to sampling points being inaccessible

Location maps are included on the following pages that indicate the locations of each of the proposed YSI and grab sample points for each TMDL receiving water as shown in **Figures 2 through 8**.

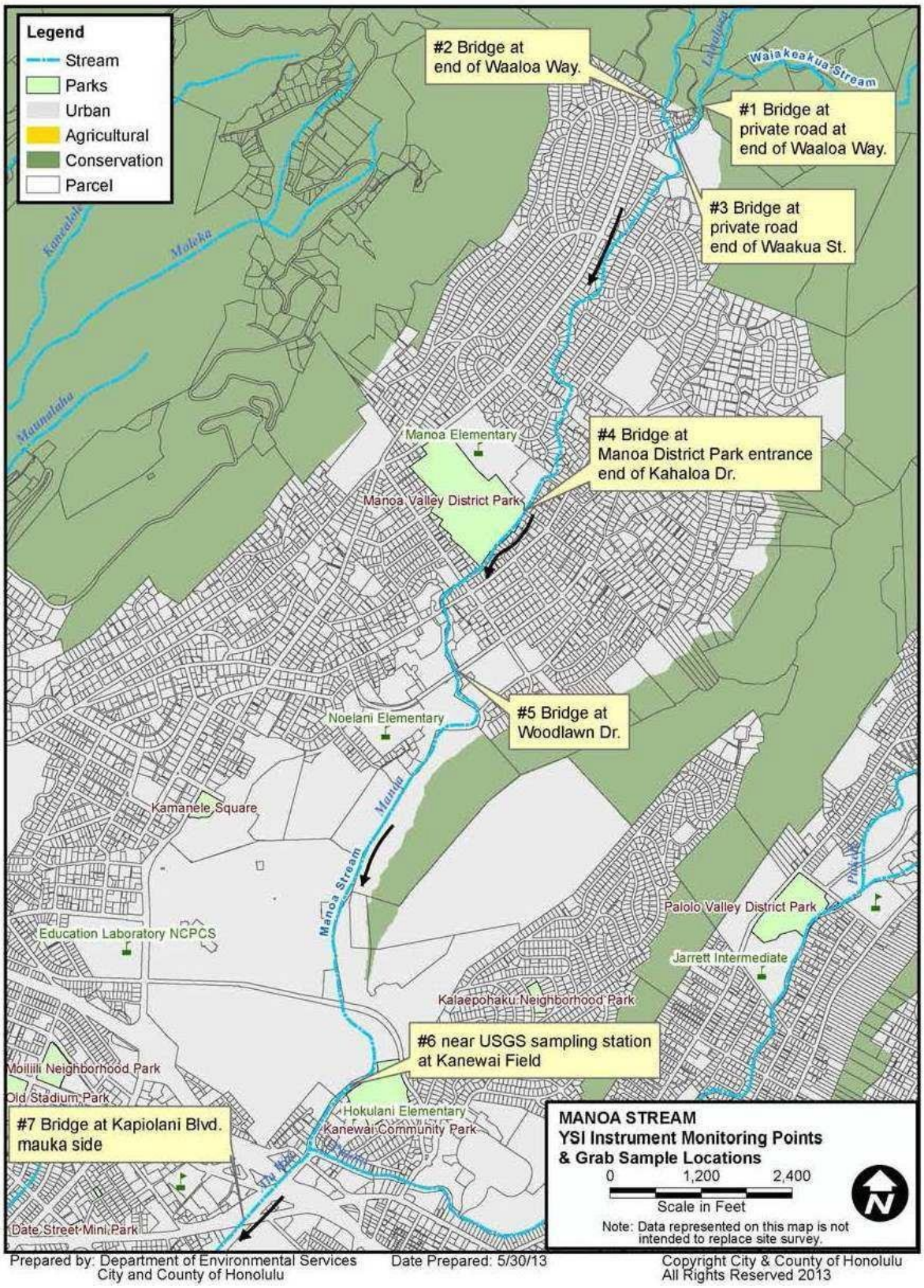

Figure 2: Manoa Stream Sampling Points

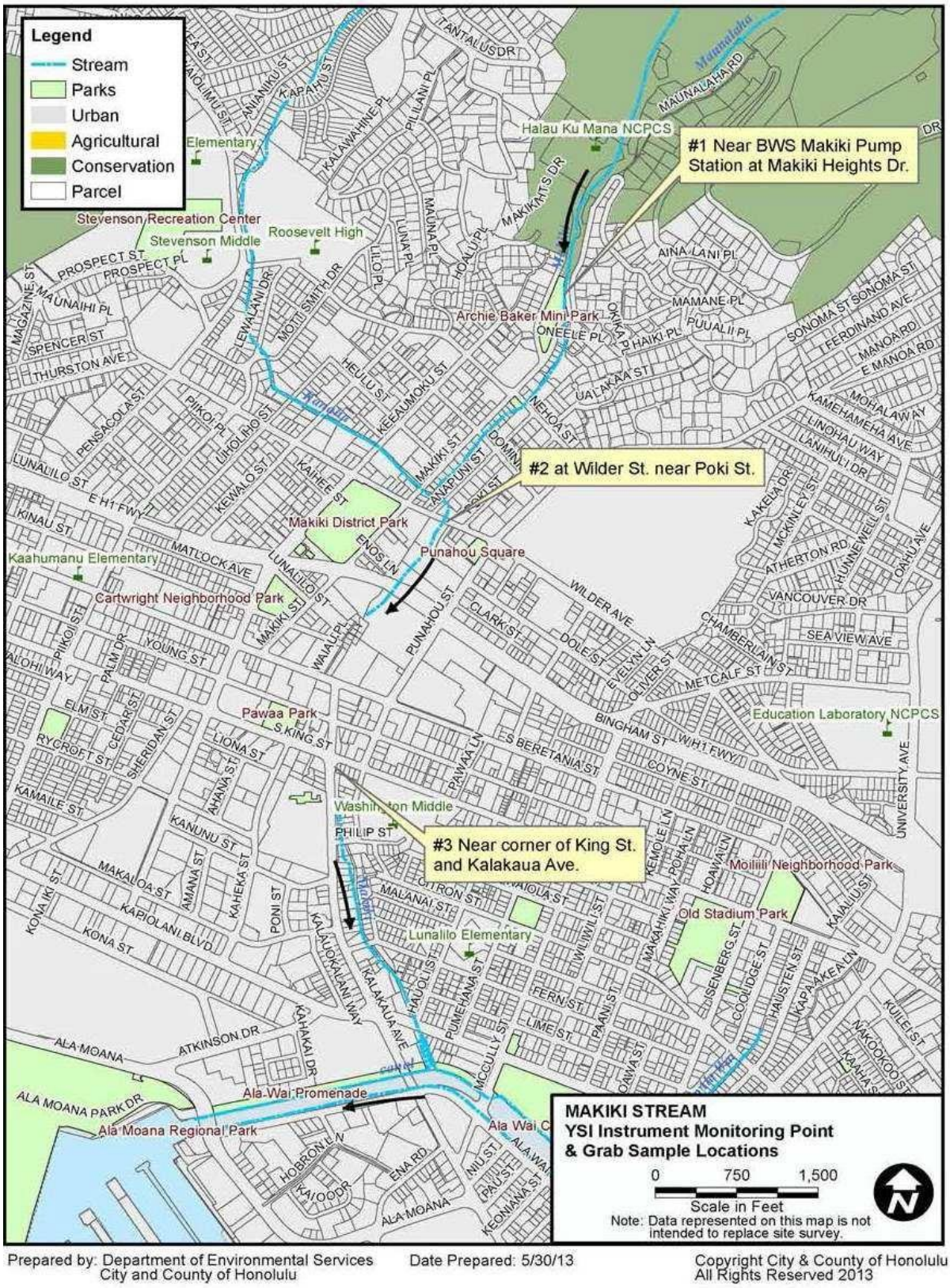

Figure 3: Makiki Stream Sampling Points

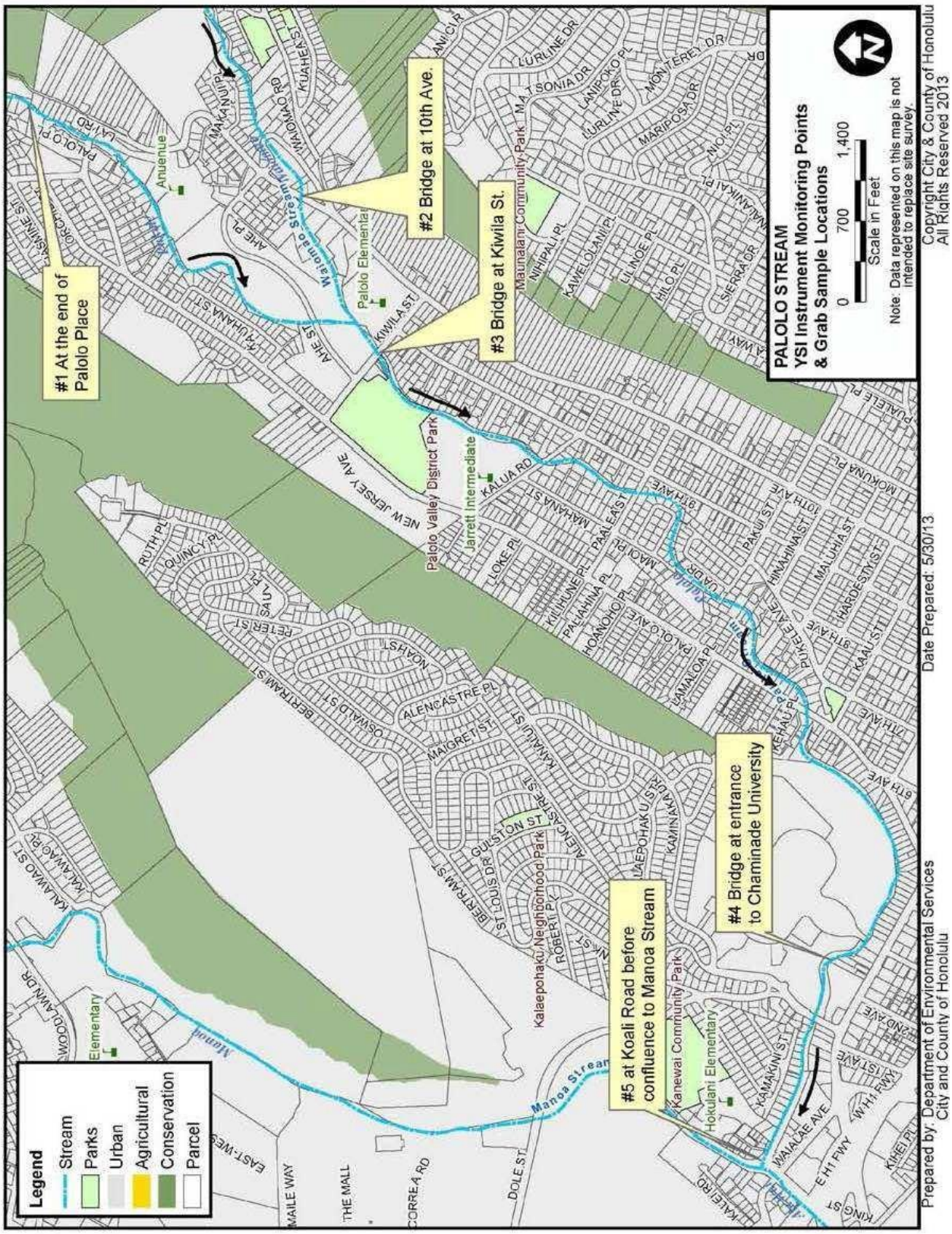

Figure 4: Palolo Stream Sampling Points

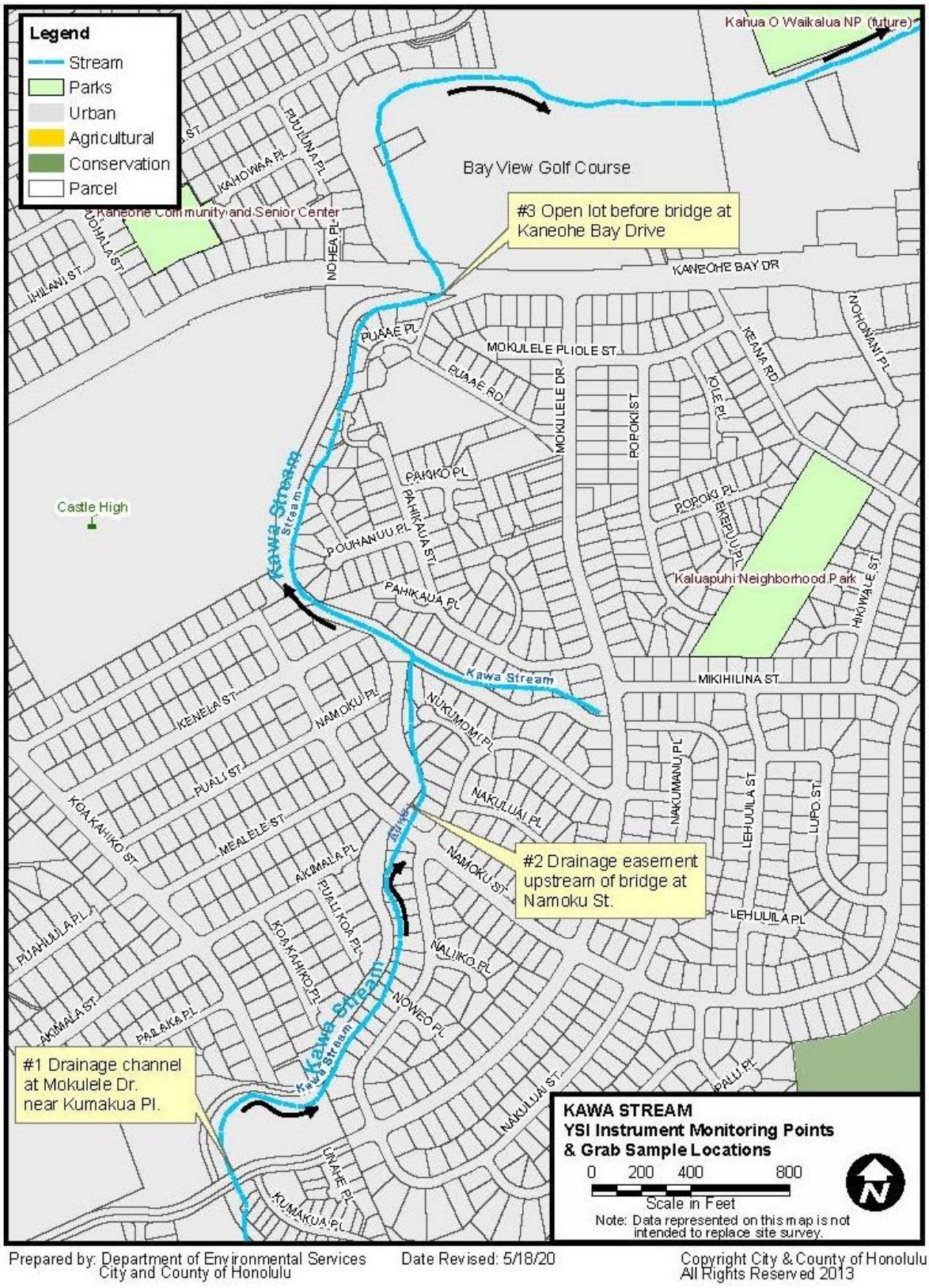

Figure 5: Kawa Stream Sampling Points

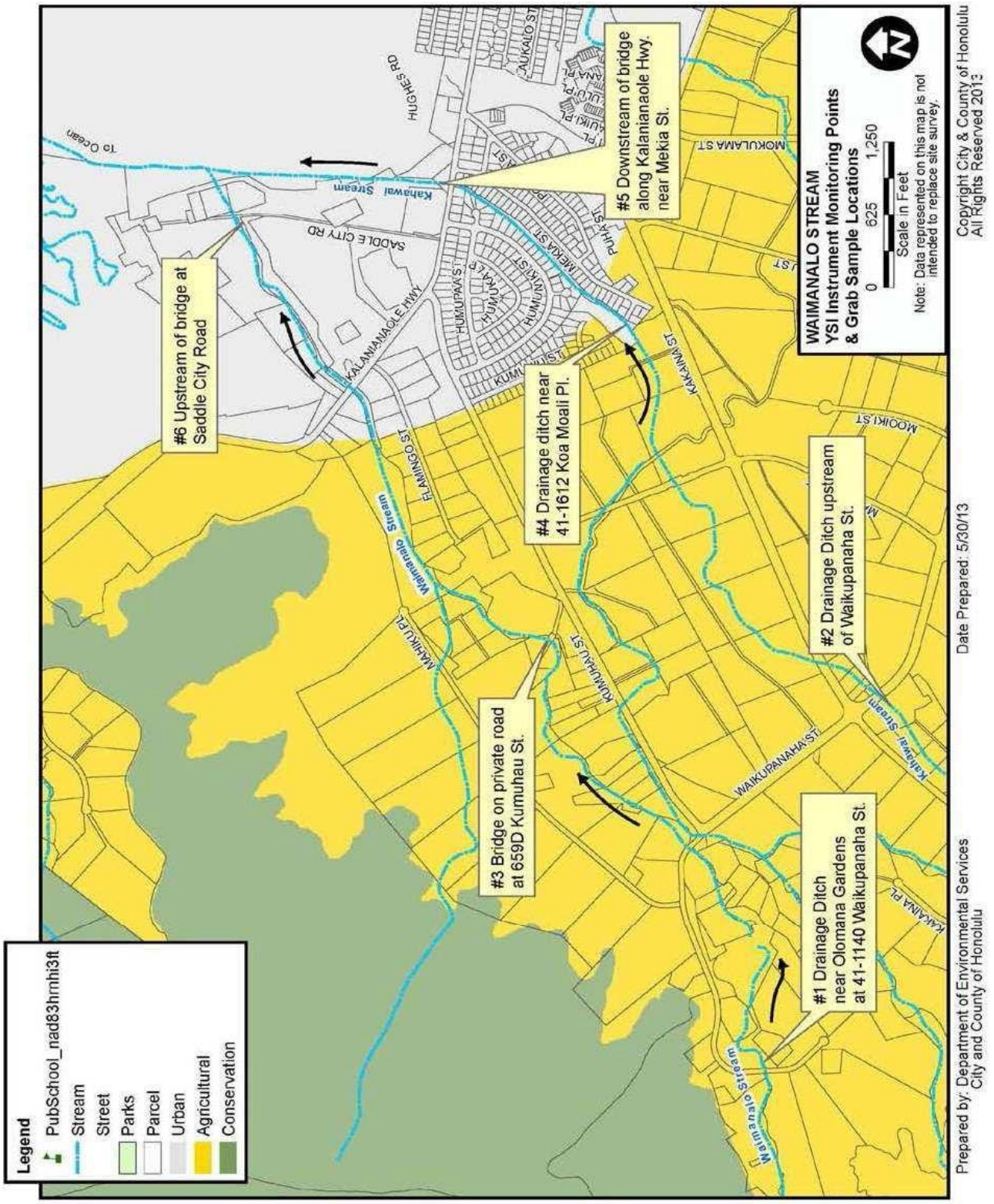

Figure 6: Waimanalo Stream Sampling Points

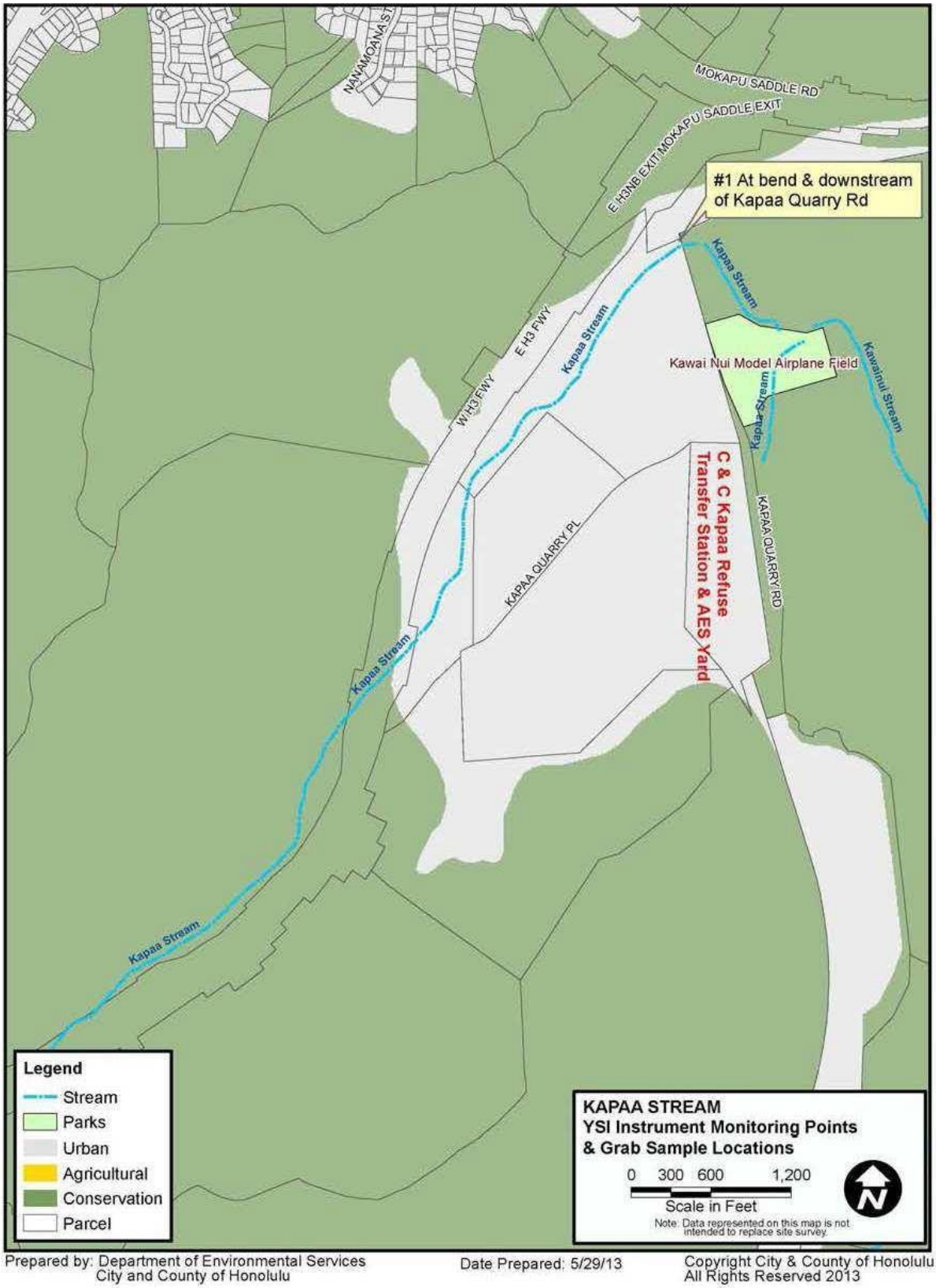

Figure 7: Kapaa Stream Sampling Points

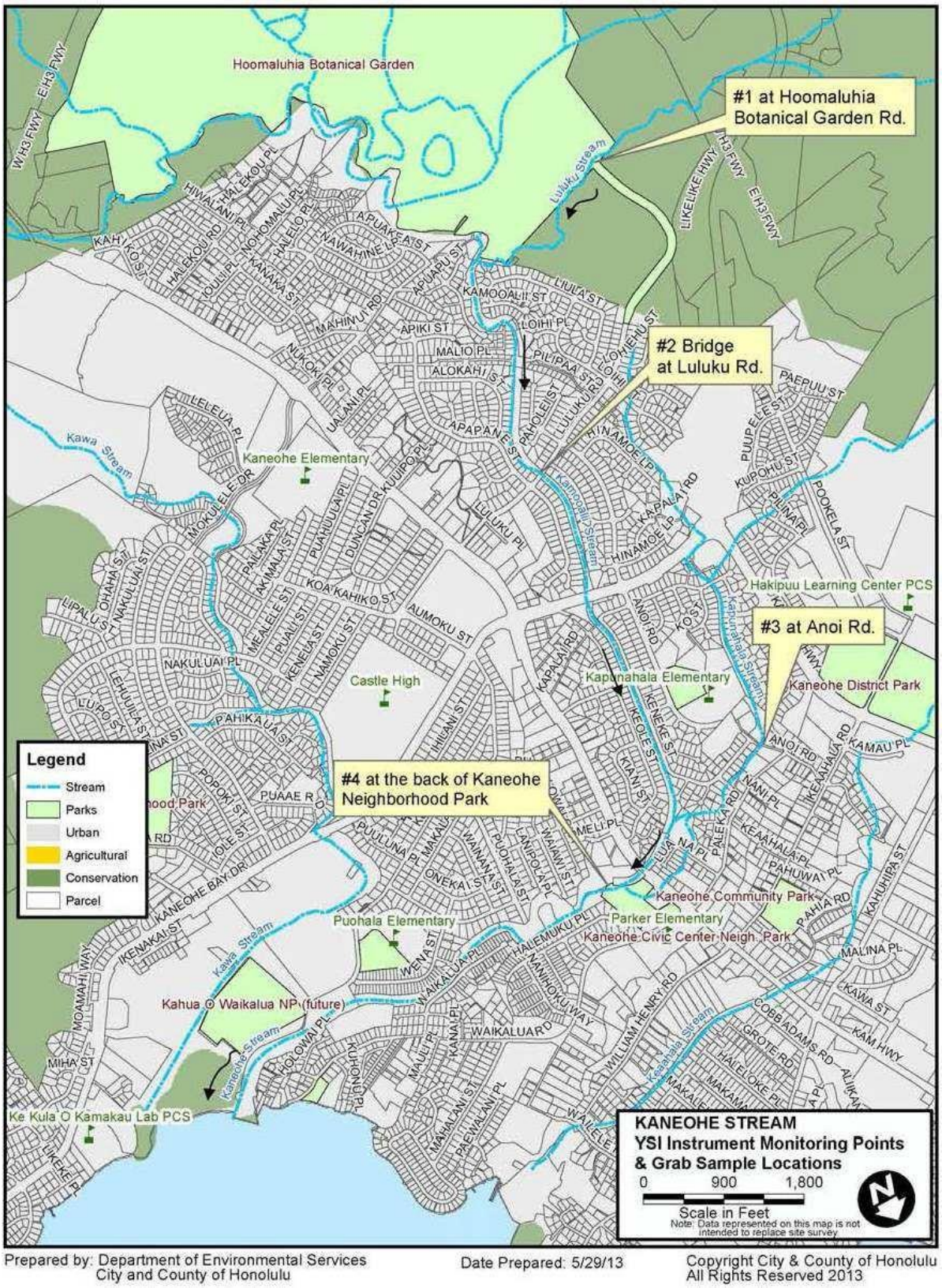

Figure 8: Kaneohe Stream Sampling Points

2) In-Stream Automated Sampling

The DFM-SWQ will continue to operate and maintain water quality monitoring stations in select streams listed on the DOH's Section 303(d) list of Water Quality-Limited Segments. The purpose of the monitoring is to determine the Event Mean Concentrations (EMCs) for representative land uses draining to the City's MS4 and to provide baseline data for TMDL WLA tracking purposes. Each in-stream location is monitored for at least two years if funding allows. The sites were selected to be upstream and downstream of an existing end-of-pipe (EOP) monitoring location on the same stream system (see Section II.B.3 for discussion of EOP sites). The purpose of this "trio" monitoring strategy (upstream, EOP, downstream) is to help evaluate the effectiveness of the City's water quality restoration programs/activities on the overall health of the stream's watershed. The Quality Assurance Project Plan for this monitoring is included in **Appendix G**.

Currently, one (1) in-stream monitoring site is active along Ahuimanu Stream (See **Figure 9** – Ahuimanu Upstream). The site was activated in FY21 and will continue to be monitored throughout FY22. This site is part of a trio of monitoring stations that also includes Ahuimanu Single Family Residential (SFR) EOP site and the Ahuimanu Downstream site (**Figure 10**), both of which were monitored from FY19 to FY21. No new stream sites are planned for FY22, but additional sites may be monitored in future years. A summary of all past, present, and planned in-stream monitoring sites is provided in **Table 2** below.

Table 2: In-Stream Monitoring Locations

Site No.	Location	Status	Comments
1	Pearl City Upstream	Completed	Monitoring concluded in FY17
2	Pearl City Downstream	Completed	Monitoring concluded in FY17
3	Manoa Upstream	Completed	Monitoring concluded in FY18
4	Manoa Downstream	Completed	Monitoring concluded in FY18
5	Ahuimanu Downstream	Completed	Monitoring concluded in FY21
6	Ahuimanu Upstream	Active	Monitoring initiated in FY21 and will continue in FY22
7	TBD	n/a	Additional sites may be initiated in future years

Each monitoring site is equipped with an automated Teledyne ISCO Avalanche Portable Refrigerated sampler, a rain gauge, an ISCO Signature portable bubbler or ultrasonic sensor flow meter, two (2) 6-volt batteries connected in series, and a 90-watt or 20-watt solar panel. The Signature unit has a built-in cellular modem to allow sampling personnel to access the monitoring data and trigger the sampling remotely. Depending on site conditions, the physical setup of the sampling equipment may vary. The parameters to be monitored include TSS, Turbidity, TKN, TN, NO_3+NO_2 as N, Ammonia Nitrogen as N (NH_3-N), Organic Nitrogen, TP, and total metals (lead, copper, and zinc). Weather permitting, it is anticipated that samples will be collected during both the wet and dry seasons in sufficient quantity to allow a meaningful analysis of the monitoring data.

At the conclusion of the FY22 monitoring period, summary calculations will be prepared which will include the results of the data analysis for all completed monitoring stations. The data will help the City evaluate the water quality impacts of its MS4 storm discharges on receiving waters, as well as

determine the effectiveness of its water quality improvement programs and activities. The data will also help identify possible pollutant sources from abutting stakeholders that are outside the City's jurisdiction, including conservation lands, agricultural lands, private properties, and Federal- and State-owned lands.

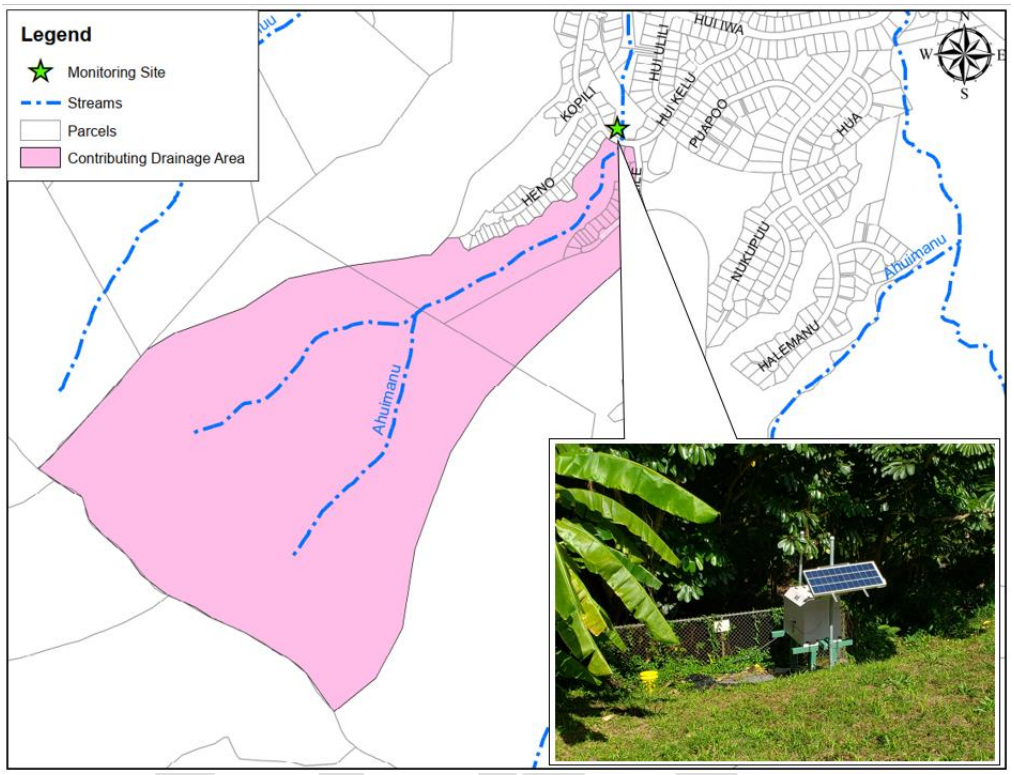

Figure 9: Ahuimanu Upstream Sampling Point

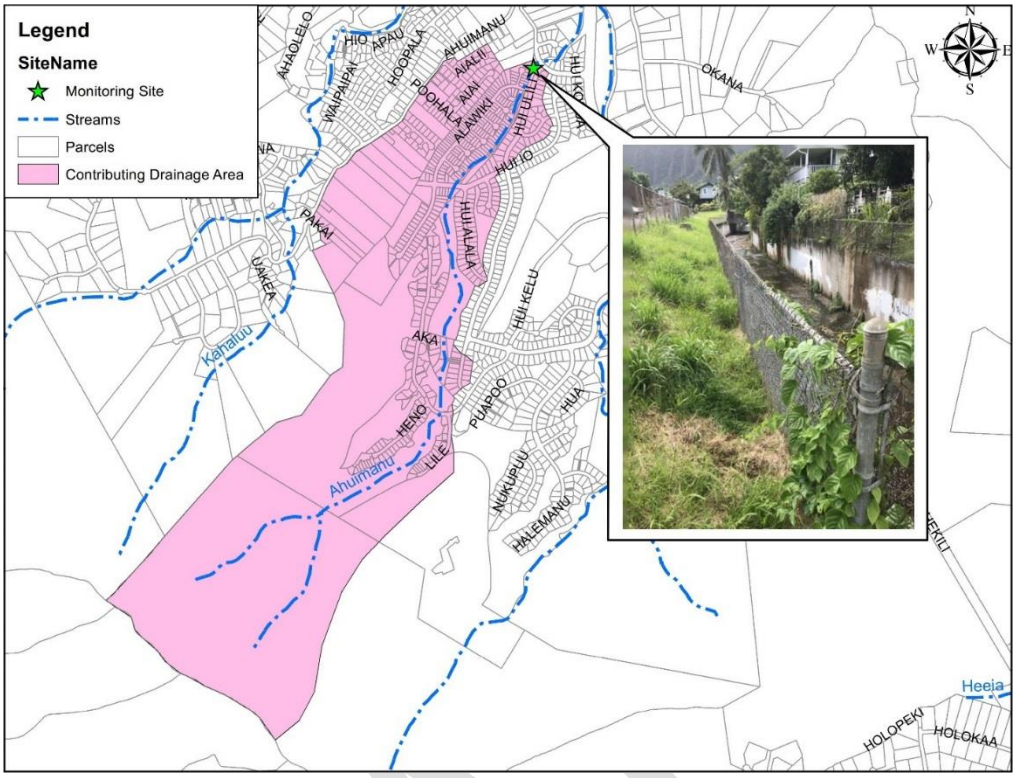

Figure 10: Ahuimanu Downstream Sampling Point

3) End-of-Pipe (EOP) Automated Sampling

The DFM-SWQ will continue to operate an EOP monitoring program in FY22 to determine the EMCs for representative land uses draining to the City's MS4. As with the in-stream sites, each EOP location will be monitored for two years if funding allows. The specific land uses to be monitored include single-family residential (SFR), multi-family residential (MFR), and light industrial land uses. Additional land uses planned for FY22 include commercial, institutional (schools/hospitals), and open spaces (parks/golf courses). The Quality Assurance Project Plan for this monitoring is included in **Appendix G**.

Currently, a total of five (5) EOP monitoring sites are active. This include Ahuimanu SFR (**Figure 11**), Waipahu MFR (**Figure 12**), Ahuimanu MFR (**Figure 13**), Pearl City Industrial (**Figure 14**), and Campbell Industrial (**Figure 15**). The purpose of the two (2) Ahuimanu sites is to monitor typical SFR and MFR runoff in windward Oahu. The Waipahu site monitors typical MFR runoff characteristics in leeward Oahu. The Pearl City and Campbell sites monitor typical runoff from industrial land use. The Pearl City Industrial site is currently on hold due to on-going roadwork in the vicinity of the monitoring station. The Ahuimanu SFR and MFR sites were also halted for several months in 2020 due to roadwork but have since been re-activated and are expected to conclude in Spring 2020 and November 2021, respectively.

Three (3) additional EOP sites are expected to be operational in FY22 or FY23 pending funding availability and the approval of construction permits. The new sites will target open space, institutional, and commercial land uses.

Twelve (12) EOP monitoring sites have been completed to date and are no longer operational. This includes: two (2) additional EOP SFR locations in Upper Wahiawa, one (1) EOP SFR location in Manoa, one (1) EOP SFR location in Pearl City, one (1) EOP MFR location in Aiea, one (1) EOP SFR site in Palolo, one (1) EOP SFR site in Waialae Iki, one (1) EOP SFR site in Kaneohe, one (1) EOP SFR site in Kawa, one (1) industrial site in Halawa, and two (2) EOP BMP Effectiveness locations in Mililani.

Table 3 below presents a summary of all the completed, existing, and proposed EOP monitoring locations. **Figure 16** illustrates the location of all the completed, existing, and proposed EOP and stream monitoring stations.

Each monitoring station is equipped with an automated Teledyne ISCO Avalanche Portable Refrigerated sampler, a rain gauge, an ISCO Signature portable bubbler or ultrasonic sensor flow meter, two (2) 6-volt batteries connected in series, and a 90-watt or 20-watt solar panel. The Signature unit has a built-in cellular modem to allow sampling personnel to access the monitoring data and trigger the sampling remotely. Depending on site conditions, the physical set-up of the sampling equipment may vary. The parameters to be monitored include TSS, Turbidity, TKN, TN, NO_3+NO_2 as N, Ammonia Nitrogen as N (NH_3-N), Organic Nitrogen, TP, and total metals (lead, copper, and zinc). Weather permitting, it is anticipated that samples will be collected during both the wet and dry seasons in sufficient quantity to allow a meaningful analysis of the monitoring data.

At the conclusion of the FY22 monitoring period, summary calculations will be prepared which will include the results of the EMC computations and data analysis for all completed monitoring stations. The EMC data obtained from this effort may be used in other parts of the City's storm water program, including:

- Permanent BMP Planning tool
- Reference data for watershed modeling, trend analysis, and development/enforcement of storm water regulations
- Tool used to identify pollutant sources in storm water
- Tool used to identify "hot spots" or problem areas and to develop subsequent solutions
- Tool used to prioritize outreach and education efforts
- Tool used to assist other stakeholders in watershed planning

The EMC data are expected to closely represent Oahu-specific land uses over a wide range of rainfall/runoff conditions. The data may also be used for the development of future TMDLs/WLAs, which have traditionally been based on mainland U.S. sources such as the U.S. Environmental Protection Agency's Results of the Nationwide Urban Runoff Program (EPA, 1983) or the National Stormwater Quality Database.

Table 3: End-of-Pipe Monitoring Locations

Site No.	Location	Land Use	Status	Comments
1	Upper Wahiawa	SFR	Completed	Completed in FY13
2	Upper Wahiawa	SFR	Completed	Completed in FY13
3	Pearl City	SFR	Completed	Completed in FY17
4	Manoa	SFR	Completed	Completed in FY18
5	Mililani	BMP Effectiveness	Completed	Completed in FY18
6	Mililani	BMP Effectiveness	Completed	Completed in FY18
7	Waipahu	MFR	Active	Monitoring ongoing, will continue in FY22
8	Aiea	MFR	Completed	Completed in FY20
9	Palolo	SFR	Completed	Completed in FY20
10	Waialae Iki	SFR	Completed	Completed in FY20
11	Kaneohe	SFR	Completed	Completed in FY20
12	Halawa	Industrial	Completed	Completed in FY20
13	Pearl City	Industrial	Active	Monitoring on hold pending on-going roadwork; will continue in FY22
14	Kawa	SFR	Completed	Completed in FY21
15	Ahuimanu	SFR	Completed	Completed in FY21
16	Ahuimanu	MFR	Active	Monitoring ongoing, will continue in FY22
17	Campbell	Industrial	Active	Monitoring ongoing, will continue in FY22
18	TBD	Open Space	In Progress	Implementation scheduled for FY22-23
19	TBD	Institutional	In Progress	Implementation scheduled for FY22-23
20	TBD	Commercial	In Progress	Implementation scheduled for FY22-23

Figure 11: Ahuimanu EOP SFR Sampling Point

Figure 12: Waipahu EOP MFR Sampling Point

Figure 13: Ahuimanu EOP MFR Sampling Point

Figure 14: Pearl City EOP Industrial Sampling Point

Figure 15: Campbell EOP Industrial Sampling Point

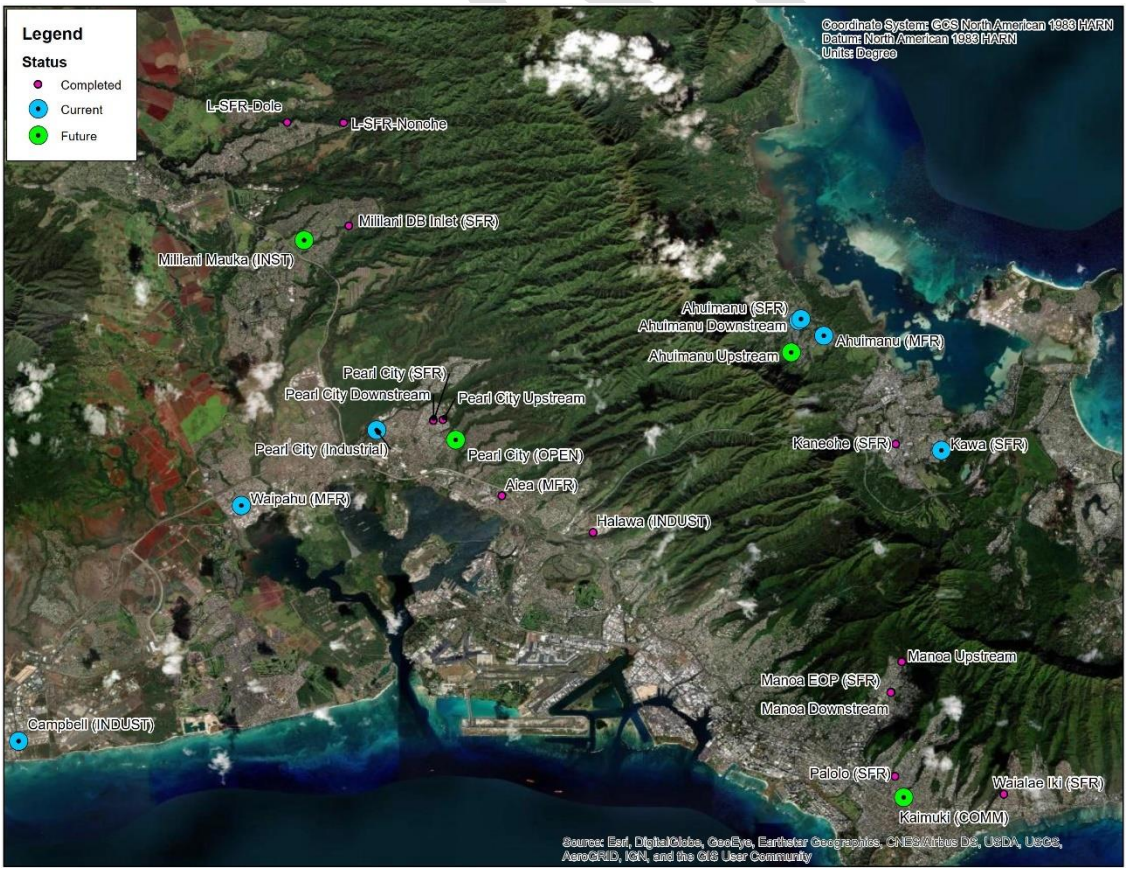

Figure 16: End-of-Pipe and Stream Monitoring Stations

4) Long-Term Mass Loading Receiving Water Sampling

The DFM-SWQ, through its cost sharing agreements and long standing partnership with the USGS, conducts monitoring activities to maintain permanent gauging stations to collect long term continuous stream measurements for both flow and turbidity within priority watersheds that have an approved TMDL such as the Ala Wai Canal, Waimanalo Stream, Kawa Stream, Kaneohe Stream and Kapaa Stream. Suspended sediment and nutrient samples are collected manually and via automatic samplers. The current monitoring agreements are scheduled to run through September 30, 2024.

The DFM-SWQ also will be continuing with administering existing monitoring agreements with the USGS for other watersheds such as Waikele Stream, Honouliuli Stream and Kaloi Gulch, which were initiated in FY17 and scheduled to conclude on September 30, 2021. However, due to the COVID-19 pandemic and delays in the installation of monitoring stations, the USGS had recently proposed to extend these agreements through September 30, 2026 at no additional cost. These watersheds were traditionally characterized as predominantly agricultural and conservation lands, but are expected to change over time, whereby resulting in an increase in the total amount of urbanized areas. The DFM-SWQ has been tracking the water quality impacts during this time as those changes start to be implemented.

Additionally, USGS and DFM-SWQ are actively discussing future plans for its Kaukonahua Stream monitoring agreement that is scheduled to expire on September 30, 2021. The State DLNR has expressed interest in partnering with the City and USGS on cost sharing the expenses to continue monitoring in this watershed.

In 2017, DFM-SWQ had concluded monitoring efforts in other watersheds such as Kaelepulu and Salt Lake areas located on the Windward and Leeward portions of the island, respectively, to identify the impacts that urbanization has had on their respective receiving waters that are both privately maintained but accept storm runoff from adjacent City outfalls and channels.

All of the above-mentioned agreements are intended to provide the DFM-SWQ with an annualized sediment load, as well as event mean concentrations for representative storms throughout the designated monitoring periods.

Table 4 below presents a summary of long-term sediment / flow sampling stations and sampling durations.

Table 4: Long-Term Sediment/Flow Sampling Locations

Waterbody/Stream	No. of Gauging Stations	Duration*
Ala Wai (**Figures 17 and 18**)	4	June 1, 2015 – Sept. 30, 2024
Waimanalo	1	June 1, 2015 – Sept. 30, 2024
Kaneohe	1	Oct. 1, 2016 – Sept. 30, 2024
Kawa	1	Oct. 1, 2016 – Sept. 30, 2024
Kapaa	1	Oct. 1, 2016 – Sept. 30, 2019
Kaukonahua (**Figures 19 and 20**)	4	June 1, 2017 – Sept. 30, 2021**
Honouliuli/Kaloi (**Figures 21 and 22**)	4	June 1, 2017 – Sept. 30, 2026
Waikele (**Figure 23**)	3	June 1, 2017 – Sept. 30, 2026
Kaelepulu	6	March 1, 2014 – Dec. 31, 2017
Salt Lake	9 2	June 1, 2015 – May 31, 2016 June 1, 2016 – June 30, 2017

* Pending budget approval for future years beyond FY22

** Subject to change, pending outcome of ongoing contract negotiations with USGS

In general, under the various long-term monitoring agreements developed with DFM-SWQ, the following specific elements for the proposed work are as outlined below:

- Obtain necessary permits and right-of-entry for new gauges;
- Construct and install new gauge equipment to measure continuous streamflow and sediment concentrations at all agreed upon sampling stations;
- Collect on a continuous basis streamflow discharge measurements and stage- discharge verifications for all agreed upon sampling stations;
- Analyze representative samples for suspended-sediment concentrations for all sampling stations including City provided refrigerated automatic samplers;
- Selected suspended-sediment samples will have additional analysis to determine the percent concentration finer than sand to ensure the automatic sampler intake is properly located and to help understand the nature of the material transported;
- Analyze relationship between turbidity and suspended-sediment concentrations to determine if turbidity is a reliable surrogate for suspended-sediment concentration;
- Compute annual suspended sediment loads for all monitoring sites based off representative samples characterized by specific land uses and drainage areas; and
- Collect quarterly samples manually and with refrigerated automatic samplers, and analyzed for selected nutrient concentrations and total suspended solids. First-flush and flow-weighted, time composite results will be provided.

By gathering both continuous stream measurements for flow and sediments and computing annualized sediment loads, it will allow DFM-SWQ to gain a better understanding of the major impacts on water quality and evaluate long term trends.

Long term sampling will be in cooperation with several existing and potential partners, including the State Department of Transportation, Highway Division (DOT-HWYs), University of Hawaii, Manoa (UH), U.S. Army Corps of Engineers (Corps or USACE), and the USGS. The discussion will focus on determining additional sampling and gaging stations, as necessary, and will include monitoring parameters to be sampled, sampling locations, and targeted land uses to be monitored. The discussion will also include potential cost sharing opportunities. The DFM-SWQ believes that the Corps and the USGS will be instrumental in providing the technical and field expertise necessary when gathering the intended water quality data to be used towards developing pollutant loads and identifying the sources of these pollutants.

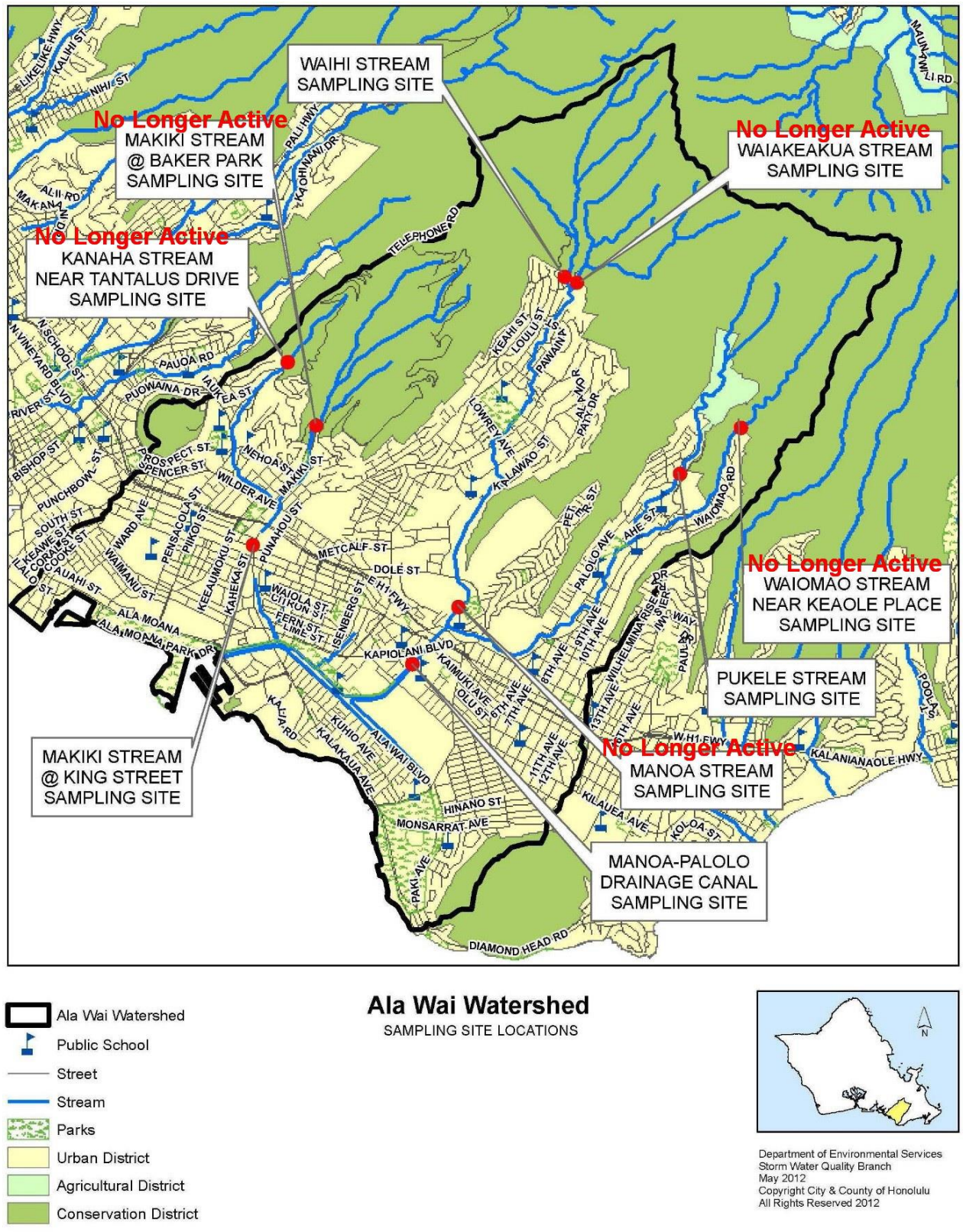

Figure 17: Ala Wai Watershed Sampling Site Locations

Waihi Stream (Upper Manoa) Wet Weather

Manoa Stream (USGS Gage Station) Wet Weather

Manoa Stream (Channelized Portion) Wet Weather

Manoa-Palolo Drainage Canal – Wet Weather

Ala Wai Canal – Wet Weather

Ala Wai Boat Harbor – Wet Weather

Figure 18: Photos of Ala Wai Watershed

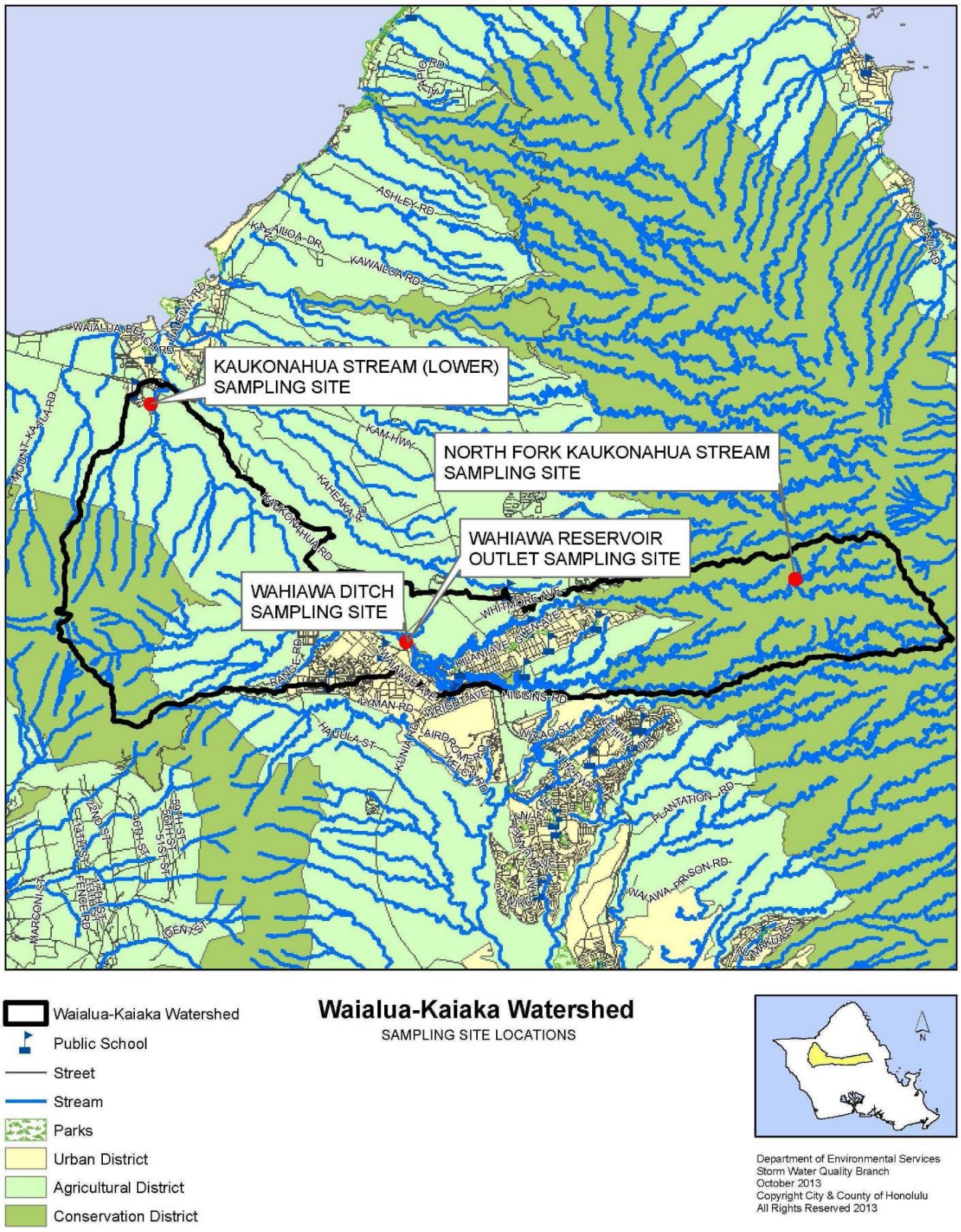

Figure 19: Waialua-Kaiaka Watershed Sampling Site Locations

Wahiawa Reservoir Dam Outlet

Upper Waialua-Kaiaka Watershed

Wahiawa Ditch Outlet to Kaukonahua Stream

Upper Kaukonahua Stream

Lower Kaukonahua Stream at Farrington Hwy.

Figure 20: Photos of Waialua-Kaiaka Watershed

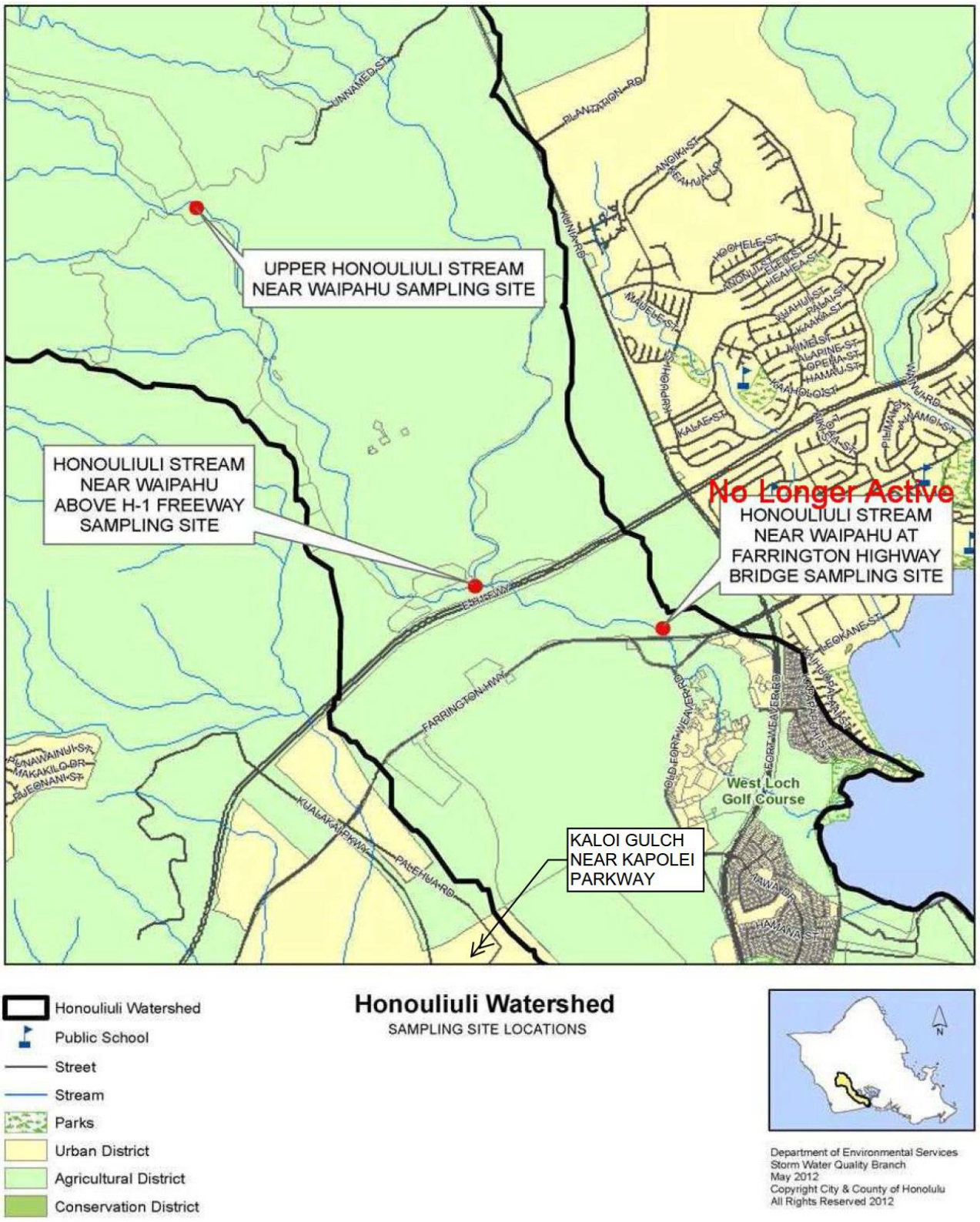

Figure 21: Honouliuli Watershed Sampling Site Locations

Upper Honouliuli Stream

Watershed (Fallow Agricultural Lands)

Honouliuli Stream at Farrington Hwy (Upstream)

Honouliuli Stream at Farrington Hwy (Downstream)

Lower Honouliuli Stream (Channelized Portion)

Lower Honouliuli Stream (Channelized Portion)

Figure 22: Photos of Honouliuli Watershed

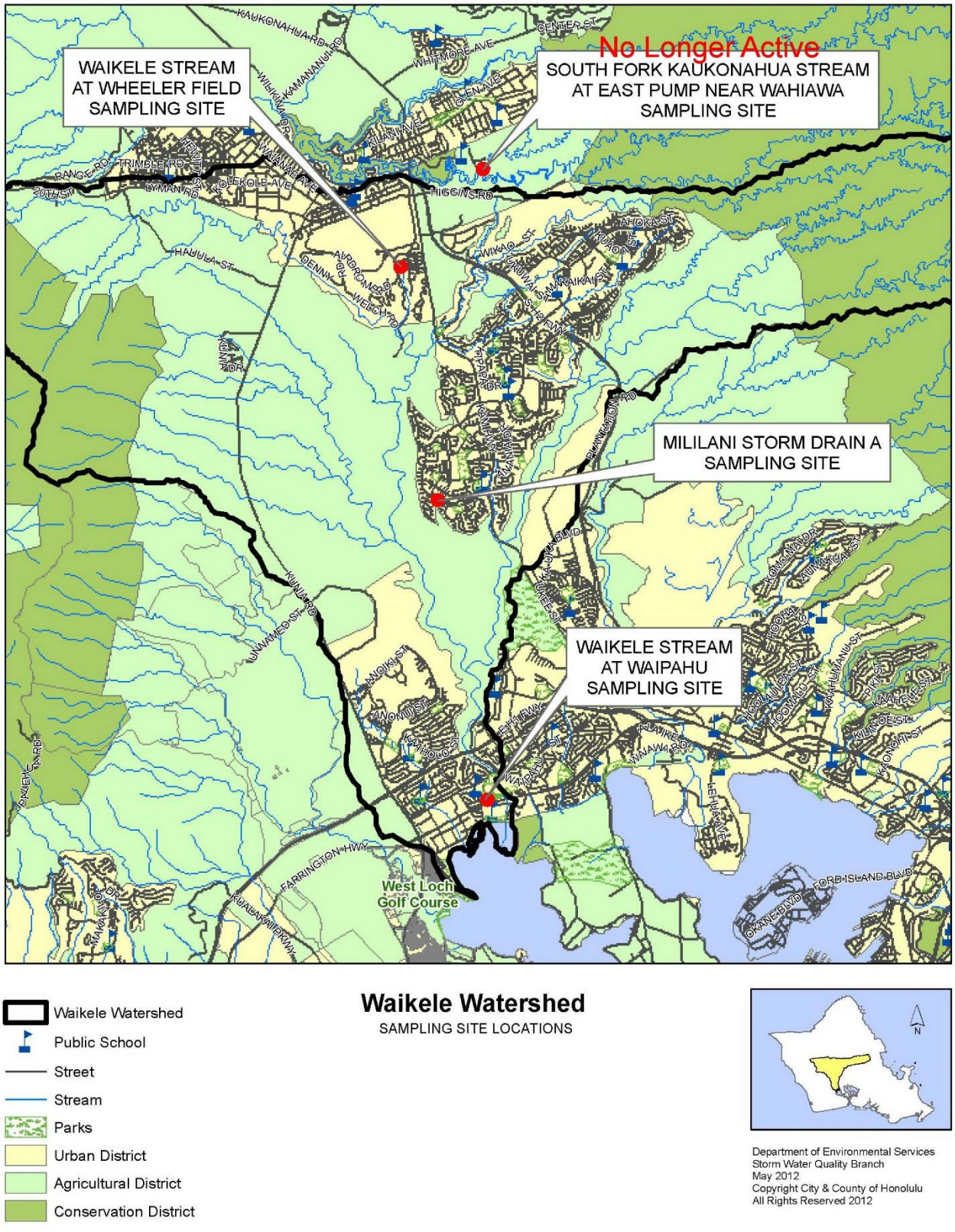

Figure 23: Waikele Watershed Sampling Site Locations

C. DRY WEATHER OUTFALL SCREENING

In February 2016, the DFM-SWQ last revised both its Response Plan for Investigations and Illegal Discharges (Response Plan) and Field Screening Plan. The Permit requires that both plans be updated one (1) year from the Permit effective date and be submitted with the City's Storm Water Management Program Plan (SWMPP). The Response Plan describes the process by which the City responds to complaints and/or reports of illicit discharges and how the City identifies illegal connections to its MS4. The Field Screening Plan focuses on methods for prioritizing and identifying screening sites for dry weather flows and establishes the protocols to mitigate the illegal discharge. Both plans work in concert to provide a comprehensive process for detecting and eliminating illicit discharges. This information will ultimately be used towards determining the effectiveness of the City's SWMP.

The Field Screening Plan includes prioritizations for observing both major and minor outfalls to screen for illicit discharges and procedures for assessing dry weather flows and erosion observed at its outfalls. Field screening in prioritized areas involves an intensive search for illegal discharges by reviewing the existing inventory and map of the storm water system in the area, conducting inspections of drain outfalls in the designated area during dry weather conditions, conducting walkthrough inspections of industrial and commercial facilities to review existing practices, encouraging businesses to use BMPs, and following up with enforcement actions when necessary. Outfalls are checked as a part of this survey and as part of follow-up investigations. Outfall inspections include a visual inspection of the physical and environmental conditions at each site. The City has established enforcement procedures for violations or deficiencies uncovered during the field screening process which is described in the City's upcoming 2021 SWMPP.

At least one (1) field screening survey has been conducted annually since 1995.

Criteria for the priority area inspections include structures located in TMDL watersheds, highly urbanized, high density areas (e.g., Waikiki and Downtown-Chinatown), findings from previous and current inspection and maintenance activities, locations of industrial and commercial facilities, documented storm water violations, and areas of homeless encampments. If a dry weather flow is observed, the flow is inspected for visual characteristics such as color, sheen, odor, and turbidity and documented with inspection forms and photographs. If such characteristics are detected, efforts will be made to trace the flow upstream to determine the location and source of the discharge and initiate appropriate enforcement actions to stop the discharge.

D. WATERSHED WATER QUALITY MANAGEMENT PROGRAM

The objective of the City's Watershed Water Quality Management Program is to prioritize and evaluate various watersheds island-wide and identify specific non-point source pollution issues within each of the targeted watersheds. The management program focuses on major land uses including urban, agriculture, conservation, and private land owners to quantify the amount of pollutants that may be contributing to the degradation of the receiving water. The long-term goal is to recommend, prioritize, educate, and implement feasible and cost-effective management measures to improve water quality. Watersheds are selected using a risk-based priority system that accounts for factors such as magnitude of pollutant load, type of impairment(s) identified in the State's 303(d) list of impaired water bodies, exposure of City-regulated facilities and MS4, and potential for water quality improvements. Once identified, the City will evaluate possible funding and potential partnership opportunities as part of a watershed assessment project.

By collecting water quality data at select points within these watersheds that may either be characterized by a specific land use and/or drainage area, the City will be able to better determine the source of the pollutants and monitor the short and long-term impacts on the surrounding stream environment, as well as track the City's progress towards meeting the TMDL requirements. Findings are planned to target resources toward reducing those particular pollutants through on-going activities, programs, or procedures that exist within the capabilities of the City. Additionally, the City is committed to working with other stakeholders and agencies in identifying BMPs or activities that could be implemented within their organizations to improve water quality as part of an integrated planning approach.

The City's watershed planning process has been following an incremental phasing approach to establish a long-term watershed monitoring strategy. The program includes the following key elements as shown in the flow chart diagram on the following page (**Figure 24**). Each phase of the plan is outlined in the sections below.

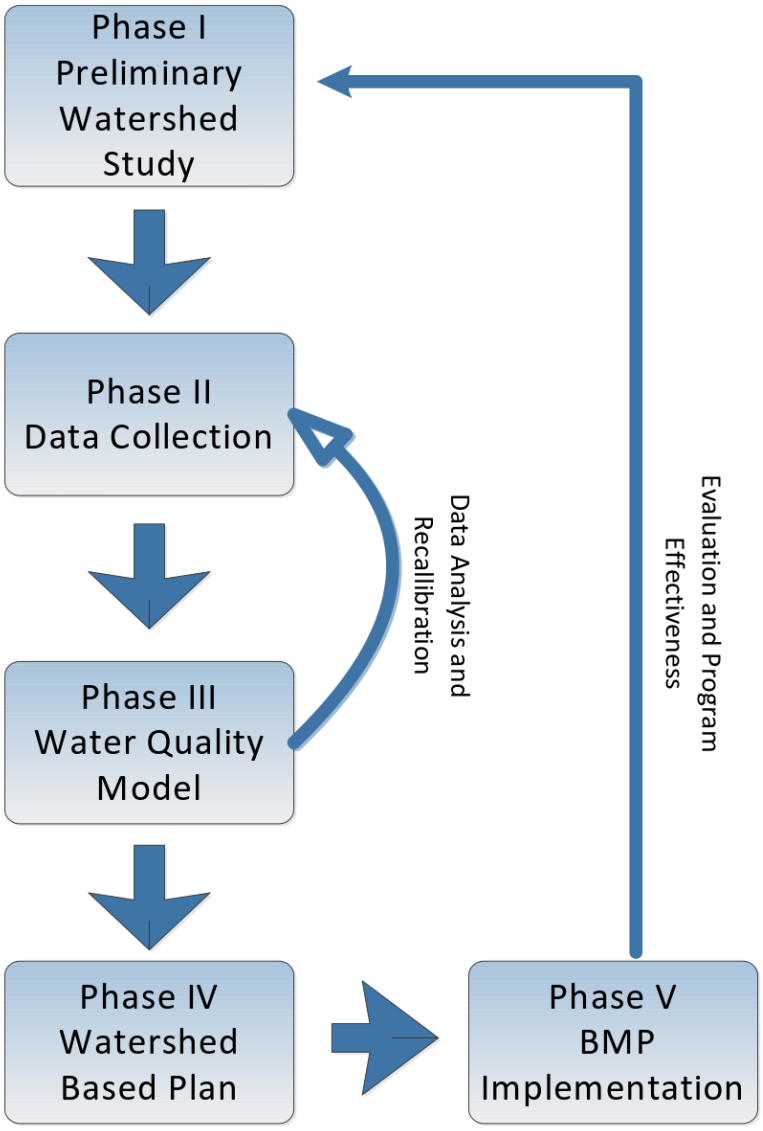

Figure 24: Watershed Management Program Flow Chart Process

1) Phase I: Preliminary Watershed (Desktop Analysis) Studies

DFM-SWQ believes that involving and collaborating with other stakeholders (e.g. large land owners, land management agencies) is necessary to attain lasting water quality improvements in the various impaired watersheds throughout the island. As such, DFM-SWQ is conducting a series of preliminary watershed studies as part of Phase I of the watershed management program. The goals of these studies are as follows:

- Identify potential sources of the pollutants and determine how it may be impacting water quality in receiving waters;
- Identify major stakeholders/landowners within the particular study area;

- Recommend mitigative measures or BMPs to improve water quality; and
- Obtain possible funding/partnership opportunities focusing on water quality.

a) Islandwide Watershed Modeling Study (PLOAD)

In FY20, DFM-SWQ completed an islandwide watershed modeling with the purpose of estimating and comparing pollutant loads across all watersheds on the island of Oahu to assist with planning, compliance, and future BMP implementation. A low complexity model, EPA-PLOAD (Pollutant Loading Estimator), was used for this purpose. The model input included the use of many publicly available GIS data layers which were modified for modeling purposes. The island of Oahu was ultimately divided into 6,419 sub-basins with average drainage areas of 60 acres to allow for sufficient discretization to identify pollution sources, but also balancing model run times and output data manageability. The model output included estimates of pollutant load by watershed, area, and land use. Heat maps were prepared to illustrate the distribution of pollutants across all 6,419 sub-basins on the island.

The PLOAD model was used to simulate BMP implementation and inform decisions regarding potential BMP implementation. Three (3) hypothetical BMP scenarios were modeled for the island of Oahu: (1) quantification of pollutant removal based on the City's inventory of existing BMPs, (2) retrofit of 20% of drain inlets with media filters, and (3) treatment of all rooftop runoff islandwide with an infiltration BMP. Of the three (3) hypothetical scenarios, the rooftop runoff scenario achieved the greatest pollutant reductions. While this option would be difficult to implement, it demonstrates the relative effect of treating impervious surface runoff with infiltration techniques which can inform other decisions regarding BMP implementation.

A report summarizing the islandwide modeling effort, "Oahu Water Quality Modeling Analysis", was published in September 2019.

2) Phase II: Data Collection (USGS and Other Automatic Sampling)

During this phase, the DFM-SWQ looks towards establishing a process for determining the overall health of a particular water body by collecting continuous stream measurements for flow and sediment that would be able to quantify and identify the major impacts on water quality which could be used towards measuring long term trends as described previously in Section II.B.4. The DFM-SWQ focused its efforts on stream sampling as a way of obtaining long term water quality data that would be needed towards establishing a baseline data set while also quantifying pollutant loads during various stages of storm events from targeted subwatersheds characterized by different land uses.

The City also collects water quality samples from its MS4 system during storm events to determine EMCs of targeted land uses.

These water quality data have been used in calibrating watershed models developed under the City's watershed management program as described in Phase III below. The data also allows the

DFM-SWQ to better understand the major impacts on water quality and evaluate long term trends of improvement or degradation.

a) Ala Wai and Other TMDL Watersheds

DFM-SWQ will continue monitoring in the Ala Wai Canal Watershed (i.e. Makiki, Manoa and Palolo Streams) and other TMDL Watersheds (i.e. Kaneohe, Waimanalo and Kawa Streams) with the assistance of USGS to collect grab and automatic samples for suspended sediment (TSS, Turbidity and Suspended Sediment) and nutrient (Total Nitrogen, Ammonia, Nitrite+Nitrate, Phosphorus, and Orthophosphate) concentrations (Phase II). The DFM-SWQ anticipates obtaining annualized sediment loads targeting multiple land uses (e.g. agriculture, conservation, residential, commercial, etc.). The current water quality monitoring agreement with USGS is scheduled to conclude at the end of September 30, 2024.

b) Central Oahu (Waikele Stream) Watershed

DFM-SWQ will continue monitoring Waikele Stream with the assistance of USGS to collect grab and automatic samples for suspended sediment (TSS, Turbidity and Suspended Sediment) and nutrient (Total Nitrogen, Ammonia, Nitrite+Nitrate, Phosphorus, and Orthophosphate) concentrations (Phase II). The DFM-SWQ anticipates obtaining annualized sediment loads targeting multiple land uses (e.g. agriculture, new residential development, etc.). The current water quality monitoring agreement with USGS was scheduled to conclude at the end of September 30, 2021. However, due to the COVID-19 pandemic and delays in the installation of certain monitoring stations, the USGS has proposed to extend these agreements through September 30, 2026 at no additional cost.

c) Waialua-Kaiaka Watershed

The current water quality monitoring agreement with USGS is expected to conclude at the end of September 30, 2021. However, due to the economic impacts related to the COVID-19 pandemic and anticipated future budget cuts, DFM-SWQ is currently re-evaluating and prioritizing its monitoring approach and agreements with USGS. Future monitoring agreements for the Federal Fiscal Year 2022 and beyond are likely to be condensed and streamlined which may result in a reduction in monitoring stations.

d) Honouliuli Stream-Kaloi Gulch Watershed

DFM-SWQ will continue monitoring Honouliuli Stream with the assistance of USGS to collect grab and automatic samples for suspended sediment (TSS, Turbidity and Suspended Sediment) and nutrient (Total Nitrogen, Ammonia, Nitrite+Nitrate, Phosphorus, and Orthophosphate) concentrations (Phase II). The DFM-SWQ anticipates obtaining annualized sediment loads from targeting multiple land uses (e.g. agriculture, conservation, etc.). The current water quality monitoring agreement with USGS was scheduled to conclude at the end of September 30, 2021. However, due to the COVID-19 pandemic and delays in the installation of certain monitoring stations, the USGS has proposed to extend these agreements through September 30, 2026 at no additional cost.

e) Salt Lake Watershed

DFM-SWQ brought in a monitoring contractor to install, operate, and monitor a number of field sampling sites to test for various water quality parameters such as TSS, Ammonia Nitrogen, Nitrate + Nitrite Nitrogen, Total Phosphorus, and Metals. The sampling program concluded in June 2017.

f) Kaelepulu Watershed

DFM-SWQ brought in a monitoring contractor to install, operate, and monitor a number of field sampling sites to test for various water quality parameters such as TSS, Ammonia Nitrogen, Nitrate + Nitrite Nitrogen, Total Phosphorus, and Enterococci. The sampling program concluded in December 2017.

3) Phase III: Water Quality Model

In Phase III of the watershed management program, DFM-SWQ developed various water quality models. The primary purposes of the modeling are as follows:

- Assist DFM-SWQ in water quality and BMP planning efforts;
- Evaluate the effects of land use changes within a particular watershed;
- Monitor and track implementation of specific BMPs and its effectiveness; and
- Develop a compliance tool to assist with current and future TMDL regulations.

Through a previous comprehensive model screening process, DFM-SWQ selected the following models: Hydrological Simulation Program – Fortran (HSPF), U.S. EPA's Storm Water Management Model (SWMM), and Pollutant Loading Estimator (PLOAD) to address different aspects of the watershed management program.

a) Islandwide Watershed Modeling Study (XPSWMM)

In FY19, when DFM-SWQ initiated the islandwide watershed modeling study (PLOAD) described in Phase I above, a concurrent modeling effort to further develop selected high priority watersheds was conducted. Similar to the PLOAD modeling effort, the purpose of the study was to estimate and compare pollutant loads across 20 priority watersheds by using a higher resolution, moderate complexity model for more detailed evaluation and BMP implementation studies. The EPA's Storm Water Management Model (SWMM), in conjunction with additional capabilities of third party enhancement software (XPSWMM) was used for this task. The 20 highest priority watersheds were selected based on three main factors which included data availability, pollution potential, and synergistic activities. Synergistic activities include the evaluation of independent activities that could provide useful data input into the model or those that require special consideration, such as TMDL watersheds. The 20 highest priority watersheds that were modeled using XPSWMM include: Ala Wai, Halawa, Heeia, Honouliuli, Kahaluu, Kalauao, Kalihi, Kaloi, Kaneohe, Kapakahi, Kawa, Kiikii, Makaiwa, Nanakuli, Nuuanu, Salt Lake, Waiawa, Waikele, Wailupe, and Waimalu.

The report summarizing the islandwide modeling effort, "Oahu Water Quality Modeling Analysis", was published in September 2019.

In FY22, the DFM-SWQ plans to expand the XPSWMM modeling to include the next tier of up to 20 high priority watersheds.

4) Phase IV: Watershed Based Study

As part of Phase IV of the watershed management program, the DFM-SWQ is planning to develop a watershed based study in accordance with the U.S. EPA's *Handbook for Developing Watershed Plans to Restore and Protect Our Waters* (March 2008). The intent is to develop a watershed based plan that meets U.S. EPA requirements, which would eventually allow the City to apply for 319(h) grant funding to implement water quality improvement projects. One key limitation of the 319(h) grant is that the projects must not be a requirement of the MS4 Permit or be included in the City's SWMP. Therefore, any acquired funding would be applied toward management of non-point pollutant sources that are not regulated under the City's NPDES Permit.

5) Phase V: BMP Implementation

The final phase of the watershed management program covers the implementation of BMPs to control pollutants entering the impaired water bodies. BMPs can be costly when accounting for both construction and maintenance costs over the lifetime of the BMP. Therefore, BMPs are typically considered a last resort after all other methods for achieving pollutant load reductions have been explored. However, one advantage of BMPs is that they provide a means of quantifying water quality improvements to help evaluate the effectiveness of a watershed management program. The City uses an adaptive management process whereby BMP implementation and monitoring programs are re-evaluated annually to identify any required changes.

a) Ala Wai Watershed Study

The USACE has been conducting a comprehensive planning study within the Ala Wai Watershed, which includes the Makiki, Manoa, and Palolo sub-watersheds. This work is in support of the multi-objective Ala Wai Watershed Project, with the overarching goal of improving the overall quality of the watershed, while minimizing the risk of flood damage to the public. The objectives of the project are flood risk management, ecosystem restoration, water quality, water supply, recreation, and infrastructure maintenance. The local sponsors for the project are the State Department of Land and Natural Resources (DLNR) Engineering Division and the DFM-SWQ.

In FY17, a calibrated water quality model using the HSPF program was completed. A BMP effectiveness tracking program was developed in FY19 and is expected to continue in FY22 to help the DFM-SWQ in identifying various planning scenarios to determine the effectiveness of the recommended structural and non-structural BMP modifications.

b) Central Oahu (Waikele Stream) Watershed Study

The Central Oahu Watershed study consists of nine (9) watersheds that comprise the Central Oahu basin and account for almost a quarter of the island of Oahu. The area drains in the southerly direction towards one of the three main lochs of the Pearl Harbor Estuary.

This study was originally started as a phased project in late 2003 under an existing agreement between the Honolulu Board of Water Supply and USACE. Phase I of the study, completed in May 2007, provided a broad overview of water-related information that could be used to identify resource problems and develop potential solutions in improving watershed health for the entire Central Oahu area that drains into the Pearl Harbor estuary, as well as lands of the Ewa District to the boundary of the Waianae District. As part of the Phase I study, a number of recommendations were presented that could assist the City with meeting these goals. The DFM-SWQ moved forward on the Phase III portion of their partnership study with the USACE to identify, recommend, and develop a calibrated model for the Waikele Stream Watershed. The study was started in December 2007 and concluded towards the latter part of FY10.

In addition to the USACE study, the DFM-SWQ also partnered with the USGS on a multi-year study of the Waikele Stream Watershed beginning in FY08. The purpose of the project was to determine the effects of upstream land uses on annual stream suspended sediment loads. The study was conducted over a period of 5.5 years in which the USGS monitored sediment loads from tributaries characterized primarily as conservation, urban, agricultural, or military source areas. The study concluded in July 2012, in which a report summarizing USGS's findings were provided to the DFM-SWQ. The results were used to evaluate source allocations in TMDL analyses being developed by the DOH and EPA for the Pearl Harbor Basin. Sediment concentrations and continuous flow readings were also incorporated into the Phase III Waikele Stream Watershed water quality model.

During FY12, the DFM-SWQ completed a geomorphic assessment of the major tributaries in the watershed to better define sediment sources and existing stream conditions. An assessment report was prepared based on the field reconnaissance work. The DFM-SWQ completed post-processing of the data by incorporating the findings into the Waikele Stream watershed model in FY19.

c) Waialua-Kaiaka Watershed Study

The Waialua-Kaiaka watershed has three (3) major perennial stream systems – Kiikii Stream (includes Poamoho Stream and the North and South Forks of Kaukonahua Stream), Paukauila Stream (includes Opaeula Stream and Helemano Stream), and Anahulu Stream (includes Kawaiki Stream, Kawainui Stream, and Kawailoa Stream). The purpose of the Waialua-Kaiaka Watershed study was to provide guidance on how to improve surface water quality of Waialua Bay, Kaiaka Bay, and their tributaries so that they meet their respective water quality standards.

The Kaiaka Watersheds are comprised of approximately 51,454 acres of land situated between the ridgelines of the Waianae and Koolau mountain ranges and extending toward

the North Shore, where the streams converge and flow into Kaiaka Bay, located in the beach town of Waialua. Together, the six Kaiaka Bay Watersheds make up approximately 13.5% of Oahu's total land area.

A watershed based plan was prepared by the City for the Kaiaka Bay Watershed in partnership with the State DOH and USEPA. The plan met the U.S. EPA's criteria for developing a watershed plan with the goal of getting all major stakeholders involved in the process. The joint funded watershed planning study (Phase IV) was cost-shared through DOH using available Federal USEPA Clean Water Act (CWA) § 319(h) nonpoint source grant-funds, while the remaining match was funded by the DFM-SWQ. The study was completed in April 2018 and is currently available on the DOH's website. Copies of the report can be downloaded at http://health.hawaii.gov/cwb/clean-water-branch-home-page/polluted-runoff-control-program/watershed-plans/. The DOH also completed its review and acceptance of the plan, in which future grant proposals for implementation are eligible for the EPA funding via the State's Request for Proposals (RFP) process.

d) Honouliuli Stream Watershed Study

Over the past several years, City facilities, namely the West Loch and Ewa Villages Golf Courses, have been damaged by flooding and heavy sedimentation loads due to large rain events. During a series of large storms that occurred in the months of February 2004 and 2006, December 2008, and January 2011, both courses faced significant damages. These damages resulted in the closure of parts of or the entire golf course for an extended period of time. According to City golf course personnel, these occurrences are becoming increasingly more frequent, and there is concern that this situation may become the norm, rather than the exception. With the increase in urban development and a large portion of the watershed devoted to agricultural and conservation lands, the DFM-SWQ felt that further studies were warranted to investigate the potential impacts that Honouliuli Stream may be having on the City's MS4 and its facilities in regard to sedimentation and water quality.

e) Salt Lake Watershed Study

In December 2003, the ENV (now DFM-SWQ) partnered with the USACE to conduct a sediment runoff analysis of the Salt Lake Watershed (Phase IV). The study was completed in August 2006. The objectives of the study were to (1) determine an estimate of annual sediment yield into Salt Lake as a result of rainfall-runoff from contributing drainage areas, and (2) provide an estimate of sediment yield into Salt Lake since 1970 for historic storm events equal or exceeding the 10-year, 1-hour rainfall intensity. The intent of this study was to provide the City with estimated quantities of sediment runoff into Salt Lake by contributing areas and provide the necessary documentation to obtain possible future assistance funding for projects that may improve water quality and environmental conditions within Salt Lake. Meanwhile, the DFM-SWQ proceeded with the design of various structural BMPs (Phase V) such as storm drain filters, inlet screens, hydrodynamic separators, and debris basins based on the prioritized drainage areas identified in the sediment study as being major contributors of the accumulated sediment in Salt Lake. To date, implementation of the storm drain filters has been completed while

construction of the hydrodynamic separator and inlet screening devices is expected to be completed in FY22. Designs for two (2) debris basins were completed in FY19 with construction anticipated to continue through FY22. The DFM-SWQ has also completed the development of a calibrated water quality model (Phase III) using the HSPF program. A BMP effectiveness tracking program was developed in FY19 and is expected to continue through FY22 to help the DFM-SWQ with identifying various planning scenarios in determining the effectiveness of the recommended structural and non-structural BMP modifications.

f) Kaelepulu Pond Watershed Study

The DFM-SWQ completed a water quality watershed planning study (Phase IV) for Kaelepulu Pond in FY19. The intent of the study was to identify the potential sources of pollutants within the watershed and recommend various BMP improvements that could be feasibly implemented to improve the overall health of Kaelepulu Pond. As part of the Kaelepulu watershed analysis study, the DFM-SWQ developed a calibrated water quality model (Phase III) using the HSPF program to identify and quantify pollutant sources, as well as prepare various simulations for different BMP scenarios that could be used in tracking specific changes within the watershed. During FY18-FY21, DFM-SWQ installed various water quality improvement projects (catch basin inlet filters and automatic retractable screens) and implemented streambank restoration projects along Kamahele Ditch and Hele Channel. The DFM-SWQ is also working closely with DOH who is in the process of developing a watershed plan and possibly a TMDL for Kaelepulu Pond.

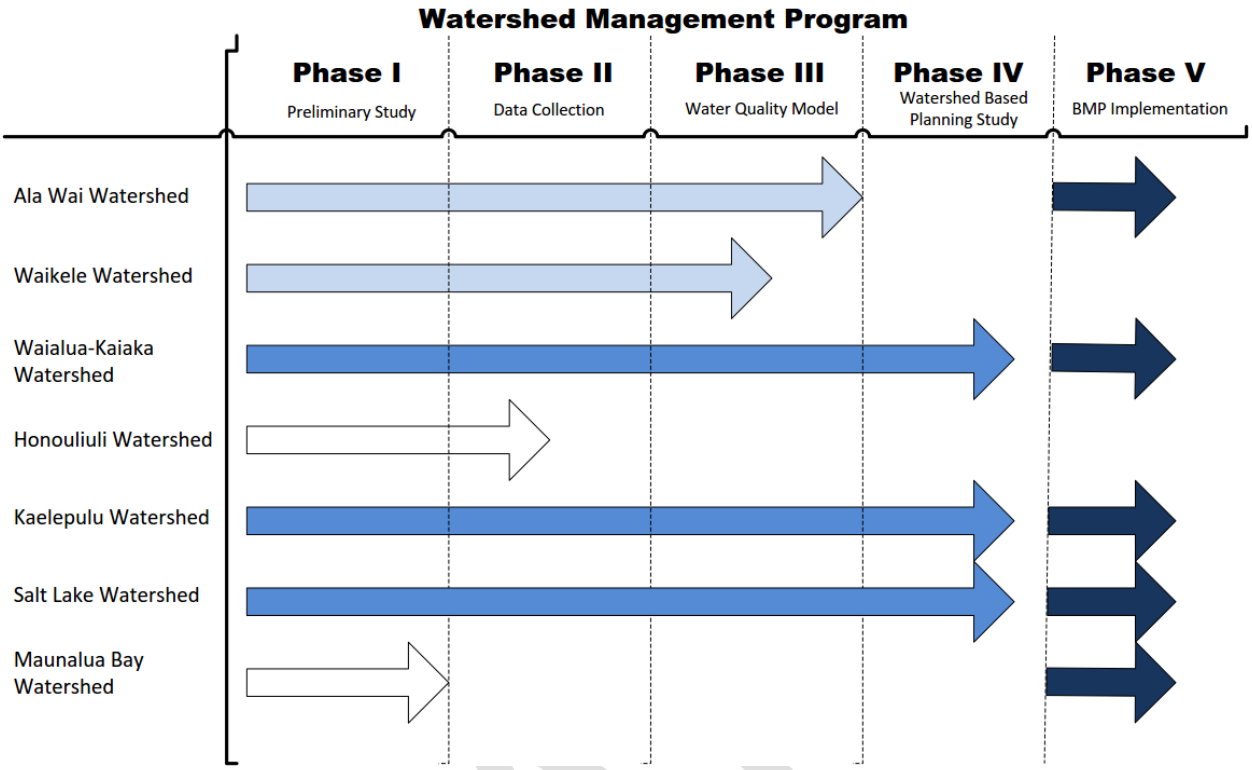

Figure 25: Watershed Management Program Overview

Table 5: Watershed Management Studies Priority Locations

Watershed	TMDL / 303(d) Listed	Other City MS4 Impacts	Partners	Pollutants of Concern	Status
Ala Wai	Yes / Yes	N/A	U.S. Army Corps of Engineers, U.S. Geological Survey, State Department of Land and Natural Resources	Sediment, Nutrients, Termiticides	Phase I completed. Phase II and III ongoing.
Waikele	Yes / Yes	N/A	U.S. Army Corps of Engineers, U.S. Geological Survey, Honolulu Board of Water Supply	Sediment, Nutrients	Phase I completed. Phase II and III ongoing.
Kiikii (Waialua -Kaiaka)	Yes (Upper Kaukonahua Stream) / Yes	Wahiawa Wastewater Treatment Plant	U.S. Geological Survey, State Department of Health	Sediment, Nutrients	Phase I and IV completed. Phase II and III ongoing.
Honouliuli	No / Yes	West Loch Golf Course	U.S. Geological Survey	Sediment, Nutrients	Phase II ongoing.
Salt Lake	No / Yes	City outfalls into privately owned waterbody	U.S. Army Corps of Engineers	Sediment, Nutrients	Phase I, II, and III completed. Phase IV and V ongoing.
Kaelepulu	No / Yes	City outfalls into privately owned waterbody	None	Sediment, Nutrients	Phase I, II, III, and IV completed. Phase V ongoing.

E. BIOASSESSMENT MONITORING PROGRAM

The DFM-SWQ, in partnership with UH, has conducted numerous bioassessments and reconnaissance surveys for select streams and watersheds within different parts of the island over many years. These studies can provide critical information as to the overall health of a watershed and identify feasibility for stream restoration projects. The data can also be used to calculate an overall mean value of biotic integrity and habitat quality for the stream and its tributaries. In addition, the data can be used to compare stream quality/condition between sites along the stream continuum in order to evaluate the effects of varying stages of urban influences on the environment of this stream.

In the past, the Hawaii Stream Bioassessment Protocol (HSBP) was applied with the following primary objectives:

- Develop a species list of fish, macroinvertebrates, and/or algae inhabiting the stream;
- Evaluate and compare the condition and species composition of the riparian area adjacent to the study stream reach;
- Evaluate and compare stream habitat quality in the study reach;
- Evaluate and compare the "biotic integrity" of the stream environment to Hawaiian "reference stream" standards; and
- Evaluate and compare the relative level of primary and secondary productivity (only if algae/invertebrate sampling is included)

Due to permitting issues, the DFM-SWQ has effectively put all future plans for its bioassessment studies on hold and is re-assessing the long-term strategy. However, in FY22, the DFM-SWQ does plan to move forward with discussions with DOH and the research community (i.e. UH, State DLNR) to identify potential opportunities to develop a bioassessment monitoring plan for the island and determine how it can be applied towards measuring program effectiveness.

F. PALOLO STREAM FOCUSED WATERSHED PLAN

In FY21, the DFM-SWQ launched a "Focused Watershed" initiative whereby resources will be redirected to a single watershed or sub-catchment to identify a variety of activities that can be implemented to determine if measurable impacts on water quality can be detected. In this case, Palolo Stream watershed has been identified as a hotspot of concern based on the results of storm water sampling, the trash baseline assessment, and the islandwide modeling study. The DFM-SWQ is in the process of data gathering, identifying pollutant sources, and coordinating brainstorming/teaming workshops. The DFM-SWQ is developing the general framework for the Focused Watershed plan, but implementation will likely be delayed due to budget constraints related to the ongoing COVID-19 pandemic. In FY22, discussions with DOH will be conducted to clarify the Focused Watershed Plan objectives.

G. CITY MUNICIPAL FACILITIES MONITORING PROGRAM

As required by the NPDES MS4 Permit for municipal industrial facilities, DFM-SWQ conducts monitoring of select City industrial facilities for representative first flush and flow-weighted composite storm water samples. DFM-SWQ has developed a priority-based monitoring schedule which places the highest priority on facilities with the greatest potential of pollutant discharge. This process involved assigning a weighted risk score (WRS) to each facility.

The Permit requires annual monitoring of storm water at all wastewater treatment plants and closed landfills. Annual storm water monitoring is also required for the facility with the highest WRS for each of the following types of industrial facilities:

- Bus Maintenance Facilities
- Rail Transit Centers, Corporation Yards & Vehicle Maintenance Yards
- Refuse Transfer Stations/ Collection Yards/ Centers.

Per Part F.2 of City's Permit, at least two (2) additional facilities from each facility type must be monitored annually, for a total of three (3) facilities per type per year[1]. A total of 20 industrial facilities will be monitored in FY22, as shown in **Table 6**: FY22 City Industrial Facilities Storm Water Sampling Schedule.

Attached for reference is DFM-SWQ's monitoring plan for City industrial facilities (**Appendix E**). This document outlines the steps to collect representative storm water samples from the targeted locations in order to fulfill the monitoring requirements of the MS4 Permit. DFM-SWQ is currently following and implementing these procedures for City facility sampling.
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[1] There are only two (2) City bus maintenance facilities.

Table 6: FY21 City Industrial Facilities Storm Water Sampling Schedule

#	Facility Name	City Department	Sampling Frequency
Wastewater Treatment Plants			
1	Honouliuli Wastewater Treatment Plant	ENV	Annual
2	Kailua Wastewater Treatment Plant	ENV	Annual
3	Sand Island Wastewater Treatment Plant	ENV	Annual
4	Wahiawa Wastewater Treatment Plant	ENV	Annual
5	Waianae Wastewater Treatment Plant	ENV	Annual
6	Waimanalo Wastewater Treatment Plant	ENV	Annual
7	Kaneohe Wastewater Pre-Treatment Facility[1]	ENV	Annual
Closed Landfills			
8	Kapaa Closed Landfill	ENV	Annual
9	Waipahu Ash Closed Landfill	ENV	Annual
10	Kalaheo Closed Landfill	ENV	Annual
11	Waianae Closed Landfill	ENV	Annual
12	Kawailoa Closed Landfill	ENV	Annual
Bus Maintenance Facilities			
13	Kalihi-Palama Bus Facility and Paratransit Facility	DTS	Annual
14	Pearl City Bus Facility	DTS	Annual
Rail Transit Centers, Corporation Yards & Vehicle Maintenance Yards			
15	Halawa (AES) Corporation Yard	DFM	Annual
16	Manana (DPR-MSS) Corporation Yard	DFM	Rotational[3]
17	Pearl City (AES) Corporation Yard	DFM	Rotational[3]
Refuse Transfer Stations/ Collection Yards/ Centers			
18	Keehi Refuse Transfer Station	ENV	Annual
19	Waimanalo Refuse Convenience Center	ENV	Rotational[3]
20	Laie Refuse Convenience Center	ENV	Rotational[3]

1) Following the completion of ongoing construction, this facility will no longer have the capacity to treat wastewater and will therefore become a non-industrial City MS4 facility and removed from monitoring.

2) These facilities were sampled in FY21 and exceeded numeric effluent limitations. DFM-SWQ continues to re-sample these facilities on a quarterly basis as the City works to resolve these exceedances. Other facilities will be rotated into this list in FY22 if the exceedances at FY21 rotational facilities have been resolved by that time.

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H. TRASH REDUCTION MONITORING PLAN

As required under the NPDES MS4 Permit, Part D.1.f.(1).(vii), the City developed and is currently implementing the 2020 Short-Term Trash Reduction Plan to reduce trash discharging from the City's MS4 by 50% of the baseline by 2023. The City completed a Trash Baseline Load Study (BLS) in 2017 to determine the baseline volume of trash discharged from the City's MS4. The BLS included a trash visual assessment to evaluate the amount of the trash on the street level.

There are four visual assessment scores: low, medium, high, and hot spot. The BLS found a high correlation between visual assessment scores and trash loading rates. Visual assessments were used to fine tune the baseline load and will continue in the future to determine the effectiveness of Trash Management BMPs. The effectiveness of full capture BMPs will be added to the Post-Construction BMP Inspection Program in the future.

The frequency of visual assessments is based on priority; segments with a higher baseline trash visual assessment score are inspected more often to confirm that trash reduction BMPs are effective. Inspection frequencies for FY21 are shown in **Table 7**. All segments will be inspected at least once per permit term.

Table 7: Visual Inspection Frequency

Visual Assessment Score	Low	Medium	High	Hot Spot
Inspection Frequency	Once per Permit Term	Bi-Annually (2x per year)	Quarterly	Monthly
Number of Segments*	13,723	1,119	150	90

*Subject to change as the program progresses and BMPs are implemented.

I. STREET SWEEPING PILOT STUDY

The City implemented a street sweeping pilot study between July 2012 and February 2017 in the TMDL watersheds to quantify pollutant removal for TSS, TN, and TP from its street sweeping operations. The objective of the study was to develop a methodology to quantify pollutant removal that occurs as part of the City's routine street sweeping operations. The City measured the volume of material collected per route, analyzed the material for nutrient content and particle size distribution, and converted the volume to mass of pollutant via EPA-published bulk density conversion factors. The data gathered has allowed the City to quantitatively determine the mass of sediments and nutrients that are removed by its street sweeping operations and to assess compliance with its WLA reductions. A report summarizing the results of the laboratory analysis and data collected was submitted to DOH in FY18. That report provides the basis on which the City currently estimates its pollutant removals via street sweeping operations in the TMDL watersheds.

Since the conclusion of the initial study, the City has expanded the pilot study to include other areas of the island beyond the TMDL watersheds. Since the beginning of FY18, the City has quantified and analyzed pollutant removals in street sweeping routes from West Oahu to Hawaii

Kai and expanded coverage in windward areas. The expanded pilot study is expected to continue in FY22 with a focus on the recently approved Waikele Stream TMDL.

J. STORM WATER MANAGEMENT PROGRAM (SWMP) EFFECTIVENESS PLAN

As required in the City's NPDES MS4 Permit, the City will continue to implement a strategy for determining the effectiveness of its SWMP. The City is in the process of finalizing its 2021 revised SWMPP and Program Effectiveness Assessment Plan (PEAP) which will be submitted to the DOH by September 1st. The PEAP includes a written strategy for determining the effectiveness of the SWMP, including a chapter on monitoring as it relates to the Permit. A copy of the PEAP from the City's 2016 SWMP (Chapter 10) is included in **Appendix F**.

Below is an excerpt from the SWMPP Program Effectiveness Plan that was proposed as the strategy for assessing the City's MS4 effectiveness in terms of water quality improvements.

In an effort to quantify the progress of program implementation and performance of BMPs, the objective of the SWMP effectiveness plan was assembled to:

- Measure progress of permit compliance and implementation of BMPs;
- Track program component effectiveness over the permit period; and
- Set the framework to be able to link program implementation with environmental improvements over time.

The City's PEAP was developed to incorporate similar elements that were used in the California Stormwater Quality Association (CASQA) approach as detailed in their 2007 manual. The approach was based on different outcomes that result from implementing storm water management programs. Outcomes are the results of implementing a storm water control measure, program activity or overall program. These outcomes are characterized into six (6) Outcome Levels which are represented below as a pyramid in **Figure 26**. The pyramid structure illustrates the progression from implementing activities to protecting water quality. In general, Outcome Levels 1 to 4 are implementation based outcomes which describe program activities, while Outcome Levels 5 and 6 are based on water quality measurements, which are more difficult to measure. Outcome Levels help categorize and define the desired results or goals of programs and control measures.

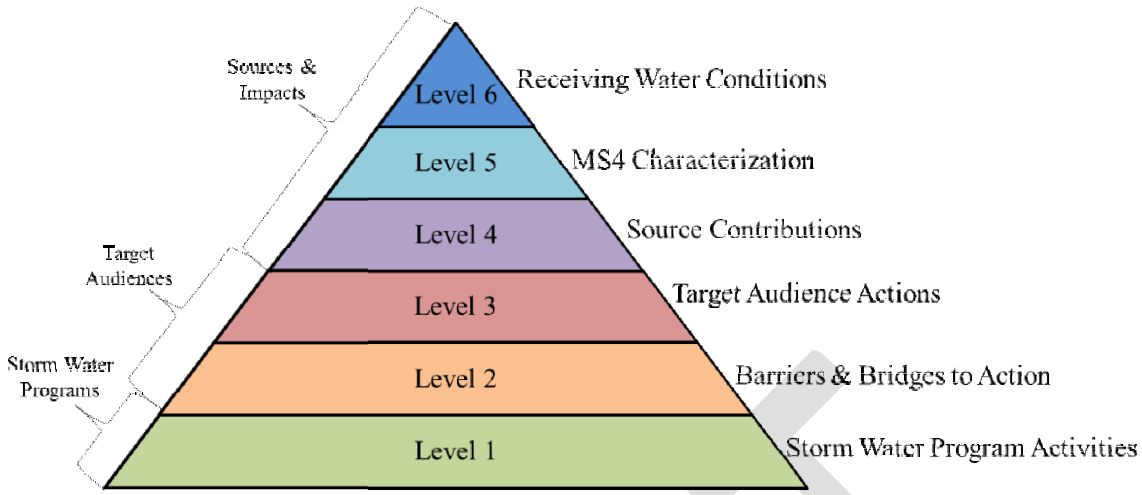

Figure 26: Program Effectiveness Outcome Levels

For the majority of the City's SWMP, its program effectiveness is determined and measured through Outcome Levels 1 through 4 by simply documenting activities, tracking the level of knowledge and awareness, observing or tracking BMP implementation as a means of determining behavior changes, and comparing baseline estimates with ongoing activities to measure the effectiveness and reduction of pollutant loads from various targeted sources. Specific Outcome Objectives and Data Assessments are described in detail within the Program Effectiveness Plan for each of the City's SWMP components under Part D of the Permit. The Program Effectiveness Assessment Plan (Chapter 10 from the 2016 SWMP) has been included as an attachment to this report under **Appendix F**, as the 2021 Plan is still under development.

In addition, the City undertakes a comprehensive water quality monitoring and activities tracking approach each year to meet the requirements as outlined in Part F of the Permit. These activities include determining compliance and assessing its overall effectiveness as they relate to water quality standards, TMDL programs, and chemical, physical and biological impacts to receiving waters.

Water quality monitoring activities are typically measured through Outcome Levels 4 through 6 as described in the City's Program Effectiveness Plan. Throughout the remainder of this plan, the DFM-SWQ outlines the proposed water quality monitoring activities over the course of this next fiscal year (FY22) that will be used to measure Permit compliance and monitor its program effectiveness. Over time, the results of these programs will serve as tools to aid the City in determining the effectiveness of its SWMP.

Many of the following water quality activities incorporate quantifying load reductions and measuring runoff quality from City facilities and its drainage system, while some activities incorporate other outcome levels such as public education and BMP evaluation. In essence, the program was designed to provide flexibility when the data assessment measures are analyzed and collected for the City to assess, evaluate, and modify their program activities at each of the various outcome levels towards setting the framework for integrated assessments in making connections between all outcome levels.

The City's water quality monitoring program has evolved over time and includes numerous opportunities for sampling such as from the City's end-of-pipe discharges, municipal facilities, trash reduction priority areas, TMDL watersheds, and BMP effectiveness assessments. This evolution is now at a point where a sufficient amount of data has been collected to support data analysis procedures to help measure individual elements of the SWMP and the effectiveness of the BMPs in place. This section presents a framework and describes what monitoring programs the City has in place to measure the effectiveness of the SWMP. The overarching framework is presented in **Figure 27**. The decision flowchart uses three pieces of information to determine if the program is effective and if the SWMP needs to be revised:

- Does data indicate a water quality problem for monitoring sub-programs;
- Is the City's MS4 the primary cause of the water quality problem; and
- Does trend analysis show improvement in water quality.

Whether or not a change to the SWMPP or Monitoring Plan is warranted depends on the answer to each question. For example, if water quality degrades and the pollutant concentrations are not decreasing over time and the City's MS4 is the primary cause of the exceedances, then it can be concluded that the BMPs in place within that particular watershed are not sufficient and the SWMPP and/or Monitoring Plan will be revised in an effort to address the issue. On the other hand, if water quality does not degrade and the pollutant concentrations are decreasing over time, then it can be concluded that the BMPs in place within that particular watershed are effective, and an assessment will be made to determine if they can be reduced or eliminated.

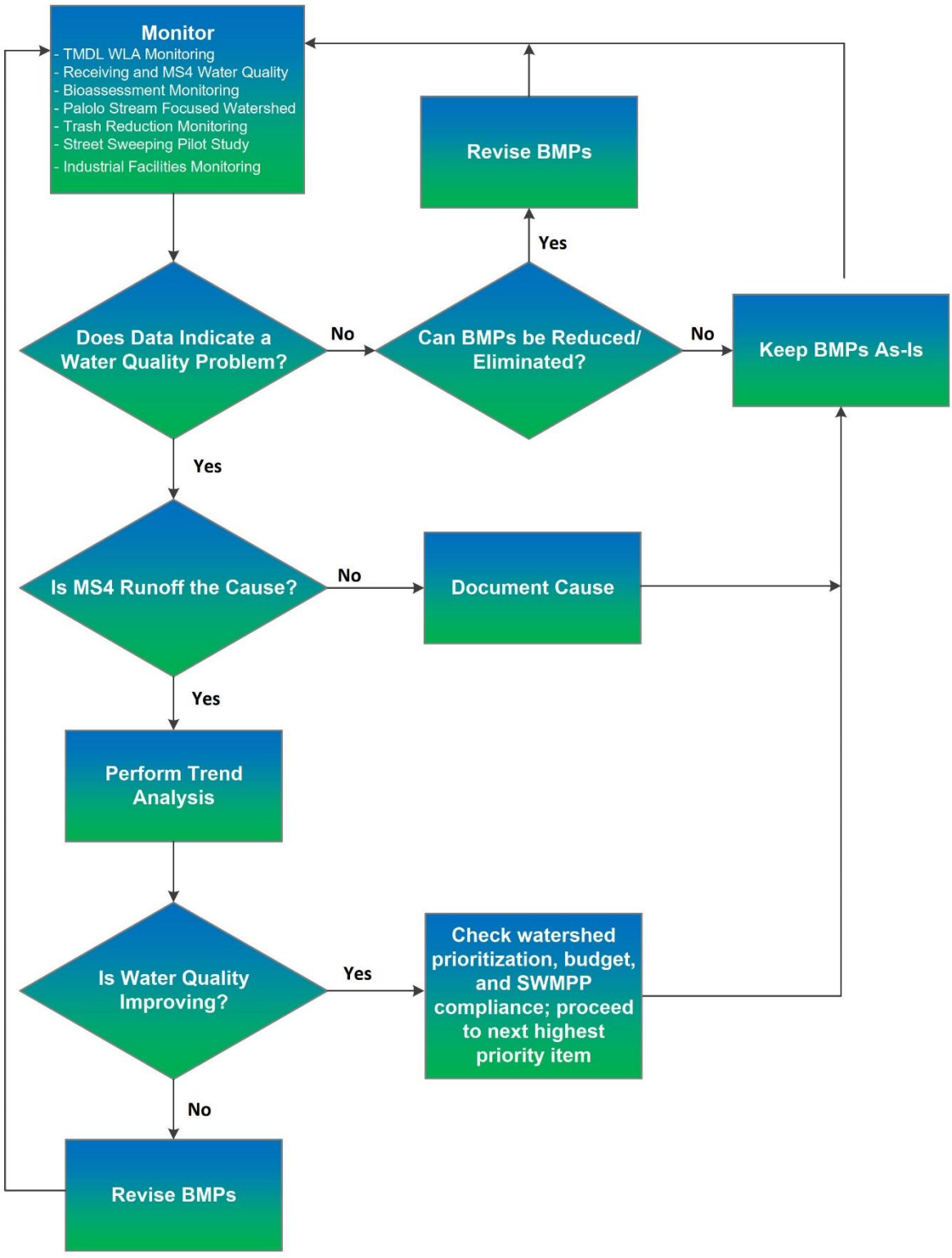

Figure 27: Water Quality Monitoring SWMP Effectiveness Assessment Matrix

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III. ANALYTICAL METHODS

As contracted by the DFM-SWQ, ALS Environmental, Inc. is expected to continue providing laboratory testing services of storm water samples delivered to them by the DFM-SWQ personnel. However, this may be subject to change based on rates charged by the contract laboratory or other circumstances. If, for any reason, the DFM-SWQ decides to switch testing laboratories, the proper procedures and test methods described in **Table 8** will continue to be followed. A list of the sampling parameters, their respective test methods, holding times, container descriptions, and preservation requirements are shown below. Further detailed information for individual parameters may be obtained upon request through ALS Environmental, Inc.

Table 8: Analyte and Sample Methods (ALS Environmental)

Analyte	Test Method *	Holding Time*	Container*	Preservation*
Biochemical Oxygen Demand (5-day)	SM 5210 B	48 hrs.	1 L G or P	<4°C
Chemical Oxygen Demand	SM 5220 B	28 days	1 L G or P	H_2SO_4 to pH < 2, <4°C
Total Suspended Solids	SM 2540 D	7 days	1 L G or P	<4°C
Total Kjeldahl Nitrogen	ASTM D1426-08B	28 days	500 ml G or P	H_2SO_4 to pH < 2, <4°C
Nitrate+Nitrite Nitrogen	EPA 300	28 days	100 ml G or P	H_2SO_4 to pH < 2, <4°C
Total Nitrogen	SM 4500	28 days	500 ml G or P	H_2SO_4 to pH < 2, <4°C
Total Phosphorus	EPA 365.3	28 days	250 ml G or P	H_2SO_4 to pH < 2, <4°C
Ammonia Nitrogen	SM 4500-NH	28 days	1 L G or P	H_2SO_4 to pH < 2, <4°C
Orthophosphates	EPA 365.3	48 hrs.	250 ml G or P	H_2SO_4 to pH < 2, <4°C
Conductivity	EPA 120.1	28 days	250 ml G or P	<4°C
Turbidity	EPA 180.1	48 hrs.	1 L G or P	<4°C
Oil and Grease	EPA 1664A	28 days	1000 ml G only	HCl to pH < 2, <4°C
Enterococci	EPA 1600	6 hrs.	500 ml G or P	<4°C
Copper	EPA 200.8	6 months	500 ml P	HNO_3 to pH < 2
Zinc	EPA 200.8	6 months	500 ml P	HNO_3 to pH < 2
Iron	EPA 200.7	6 months	500 ml P	HNO_3 to pH < 2

* EPA Methods for Chemical Analysis of Water and Wastewater (April 2007)

Table 9: Analyte and Sample Methods (YSI 6600 Multi-Parameter Water Quality Sonde)

Analyte	Test Method*	Holding Time*	Equivalent EPA Method
pH	4500-H+	None[1]	EPA 150.1
Temperature	2550	None[1]	EPA 170.1
Turbidity	2130-B	24 hrs	EPA 180.1
Conductivity	2510A	None[1]	EPA 120.1
Dissolved Oxygen	4500-OG	None[1]	EPA 360.1

* Standard Methods 19th Edition (1995)

[1] "None" indicates that the sample analyses must be performed immediately after sample collection or in the water column at the site.

IV. QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Accurate and reliable data are required by the DFM-SWQ to meet the standards set by the State and/or Federal regulations. Since engineering and environmental decisions are based on the data produced, it is essential that clear and extensive verification procedures be established. Currently, ALS Environmental, Inc. provides the DFM-SWQ with the laboratory expertise for storm water monitoring analyses. As part of the Permit, the DFM-SWQ requested the contract laboratory provide a written Quality Assurance/Quality Control (QA/QC) document. This document includes the following items:

- Company Overview (scope and goals of the company)
- Organization
- Certification
- Professional Staff
- Equipment and Facilities
- Sample Handling and Procedures
- Analytical Quality Control
- Data Validation and Reporting
- Documentation
- Quality Assurance

The document serves as a written agreement that ensures and validates the quality of the data packages received. A copy of the QA/QC report for ALS Environmental is attached in **Appendix A**.

The USGS QA Plan which describes the various operations and organizations within the USGS and their roles in the suggested quality control practices for obtaining sediment data is included in **Appendix B**. The USGS QA/QC guidelines for the determination of sediment concentration by USGS sediment laboratories is included as **Appendix C**. The guidelines are directed toward the use of acceptable laboratory procedures for the processing and analysis of suspended-sediment samples and the documentation of QA practices.

The DFM-SWQ also has a QA plan and procedure for sampling using the YSI Multi- Parameter Water Quality Sonde and monitoring procedures for storm water sampling at City industrial facilities. A copy of the YSI QA Monitoring Plan is included in **Appendix D.**

The City's Municipal Facility Storm Water Monitoring Procedures is included in **Appendix E**.

A copy of the Quality Assurance Project Plan for City and County of Honolulu NPDES MS4 End-of-Pipe and Stream Monitoring Program (May 2021) is included in **Appendix G.**

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V. ESTIMATED FY22 MONITORING BUDGET

For FY22, the projected expenditures would be approximately $1,850,000. This includes, but is not limited to, the quarterly stream sampling and analysis involving the use of YSI monitoring probes, water quality lab analysis, suspended sediment sampling, planning and initiation of an islandwide biological assessment program, island-wide watershed modeling, trash reduction monitoring, municipal facilities monitoring, focused watershed plan, efforts to develop or revise existing Implementation and Monitoring plans to address the seven (7) WLAs described in the City's NPDES MS4 Permit, BMP and TMDL tracking activities, and other partnership monitoring efforts. Additionally, the Ala Wai, Waikele, Honouliuli, Waialua-Kaiaka, Salt Lake, and Kaelepulu watershed management studies have been included in the overall monitoring budget. Projected expenditures are subject to approval by the City Council. It should also be noted that budgets are subject to change based on MS4 Permit negotiations and program activities that are revised to be consistent with Permit conditions.

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